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VECTOR



VN1600 Interface Family Manual

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1 Introduction

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1.1 About this User Manual

Conventions

In the two following charts you will find the conventions used in the user manual regarding utilized spellings and symbols.

Style	Utilization
bold	Blocks, surface elements, window and dialog names of the software. Accentuation of warnings and advices. **[OK]** Push buttons in brackets **File|Save** Notation for menus and menu entries
`Source Code`	File name and source code.
Hyperlink	Hyperlinks and references.
<CTRL>+<S>	Notation for shortcuts.

Symbol	Utilization
	This symbol calls your attention to warnings.
	Warning of damages by electrostatic discharge (ESD = Electrostatically Sensitive Device).
	Here you can obtain supplemental information.
	Here you can find additional information.
	Here is an example that has been prepared for you.
	Step-by-step instructions provide assistance at these points.
	Instructions on editing files are found at these points.
	This symbol warns you not to edit the specified file.

1.1.1 Warranty

Restriction of warranty

We reserve the right to change the contents of the documentation and the software without notice. Vector Informatik GmbH assumes no liability for correct contents or damages which are resulted from the usage of the documentation. We are grateful for references to mistakes or for suggestions for improvement to be able to offer you even more efficient products in the future.

1.1.2 Registered Trademarks

Registered trademarks

All trademarks mentioned in this documentation and if necessary third party registered are absolutely subject to the conditions of each valid label right and the rights of particular registered proprietor. All trademarks, trade names or company names are or can be trademarks or registered trademarks of their particular proprietors. All rights which are not expressly allowed are reserved. If an explicit label of trademarks, which are used in this documentation, fails, should not mean that a name is free of third party rights.

- Windows, Windows 7, Windows 8.1, Windows 10, Windows 11 are trademarks of the Microsoft Corporation.
-  and  are trademarks of the SD Card Association.

1.2 Important Notes



Caution!
We provide our important notes and safety instructions in several languages, including Englisch (EN) and German (DE). For more details, see the relevant section:

- EN: Important Notes - Details
- DE: Wichtige Hinweise

2 VN1600 Interface Family

In this chapter you find the following information:

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2.1 Introduction

General information

The VN1600 interface family is a flexible and cost-efficient solution for CAN, CAN FD, CAN XL, LIN, K-Line, J1708 and SENT (only VN1640A) applications. An excellent performance with minimal latency times and high time stamp accuracy is also guaranteed.

The multi-application functionality of the VN1600 interface family supports simultaneous operation of different applications on one channel, e. g. CANoe and CANape. Tasks range from simple bus analyses to complex remaining bus simulations also diagnostic, calibration and reprogramming tasks as well as LIN 2.1 compliance tests.

Bus types

Depending on the VN1600 interface, built-in transceivers as well as exchangeable CAN, LIN, J1708 and SENT transceivers can be used. The exchangeable transceivers are available as plug-in boards (piggybacks) and are inserted in the VN1600. A list of compatible piggybacks can be found in the accessories manual or on our website.

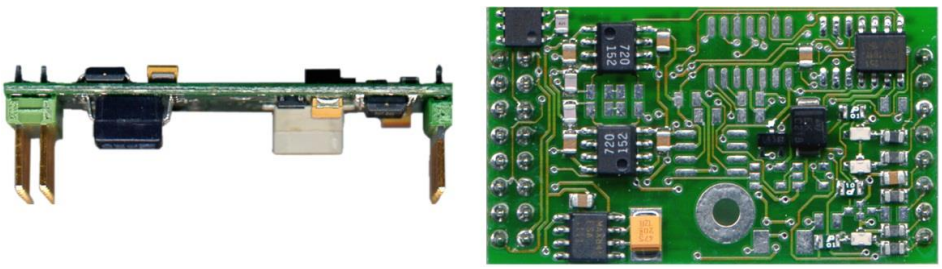


Figure 1: Piggyback

2.2 VN1610

2.2.1 Main Features

VN1610 features

The main features of the VN1610 interface are:

- 2x CAN high-speed 1051cap transceiver (capacitively decoupled)
- Software sync



Figure 2: VN1610 CAN Interface

2.2.2 Connectors

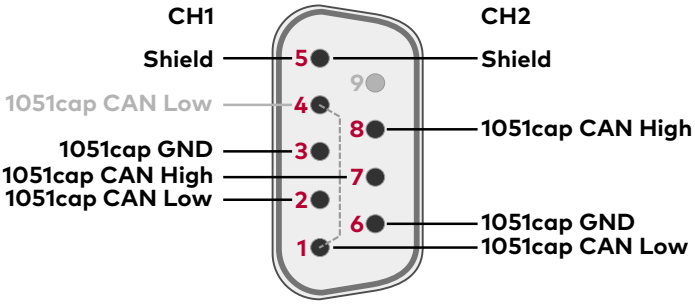
- **D-SUB9 (CH1/2)**
  The VN1610 has a D-SUB9 connector with two CAN channels. Further information on the pin assignment for CH1/CH2 can be found in section Pin Assignment CH1 and CH2 on page 14.
- **USB**
  Connect your computer and the VN1610 via USB to install and to use the device with measurement applications (e. g. CANoe, CANalyzer).

2.2.3 Pin Assignment CH1 and CH2

D-SUB9 connector

The pin assignment of the D-SUB9 connector (CH1 and CH2) is as follows:

CH1/CH2



CAN Y cable

Use the CANcable 2Y to access both channels on separate D-SUB9 connectors (see accessories manual, part number 05075).

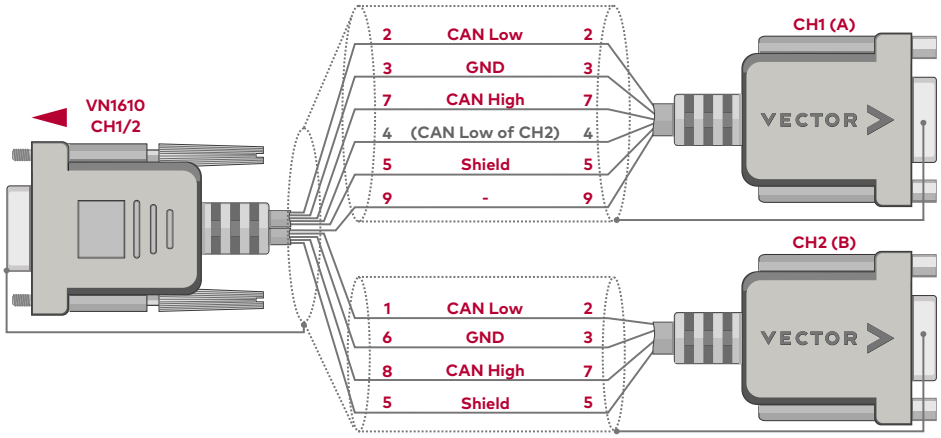


Figure 3: CANcable 2Y connected to VN1610

2.2.4 Technical Data

CAN channels	2x CAN high-speed 1051cap Bitrates - CAN: up to 1 Mbit/s (up to 2 Mbit/s depending on wiring and transceivers) - CAN FD: up to 5 Mbit/s (up to 8 Mbit/s depending on wiring and transceivers)
Time stamps	Accuracy (within one device): 1 µs Accuracy software sync: typ. 50 µs
Temperature range	Operating: -40 °C...+70 °C Shipping and storage: -40 °C...+85 °C
Relative humidity of ambient air	15 %...95 %, non-condensing
Dimensions (LxWxH)	65 mm x 42 mm x 20 mm
Weight	80 g
Operating system requirements	Windows 10 (x64, 64 bit) Windows 11 (x64, 64 bit)

2.2.5 Accessories



Reference
Information on available accessories can be found in the separate accessories manual on our website.

Cables and connectors

- CANcable0
- CANcable1
- CANcableA
- CANcable Y
- CANcable 2Y
- CANterm 120
- CANcable Set Pro
- USBadapter 3.2 Gen 1 C-A SDSL (Single Screw Lock)

2.3 VN1611

2.3.1 Main Features

VN1611 features

The main features of the VN1611 interface are:

- 1x LIN 7269cap transceiver (capacitively decoupled)
- 1x CAN high-speed 1051cap transceiver (capacitively decoupled)
- Software sync



Figure 4: VN1611 LIN/CAN Interface

Note
The VN1611 does not support LIN2.1 compliance tests. Please use the VN1630A or the VN1640A for these purposes.

2.3.2 Connectors

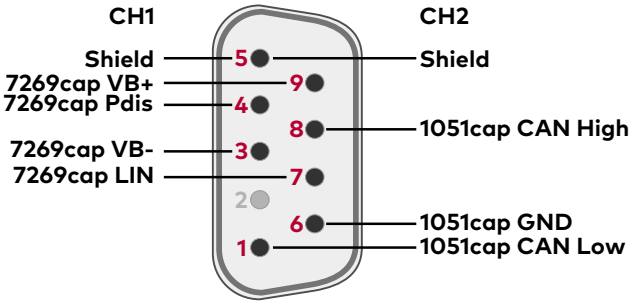
- **D-SUB9 (CH1/2)**
  The VN1611 has a D-SUB9 connector with one LIN and one CAN channel. Further information on the pin assignment for CH1/CH2 can be found in section Pin Assignment CH1 and CH2 on page 17.
- **USB**
  Connect your computer and the VN1611 via USB to install and to use the device with measurement applications (e. g. CANoe, CANalyzer).

2.3.3 Pin Assignment CH1 and CH2

D-SUB9 connector

The pin assignment of the D-SUB9 connector (CH1 and CH2) is as follows:

CH1/CH2



Pdis: power disable

Note

Please note that pin 3 (VB-) is the reference potential for pin 7 (7269cap LIN). So pin 3 could also be called „7269cap GND". It is electrically isolated from pin 6 (1051cap GND).

CAN/LIN Y cable

Use the CANcable 2Y to access both channels on separate D-SUB9 connectors (see accessories manual, part number 05075).

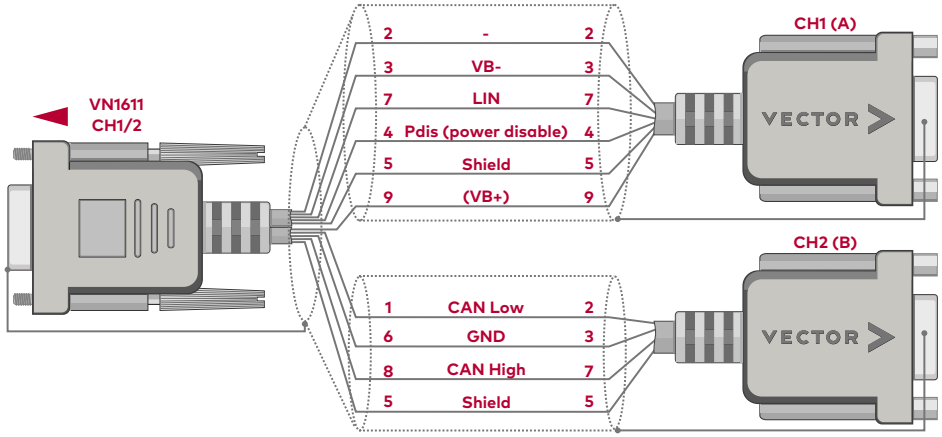


Figure 5: CANcable 2Y connected to VN1611

Note

If pin 4 (Pdis) is connected to pin 3 (VB-), the internal power supply is disabled. In this case an external power supply is required at pin 9 (VB+).

2.3.4 Technical Data

CAN channels	1x CAN high-speed 1051cap Bitrates - CAN: up to 1 Mbit/s (up to 2 Mbit/s depending on wiring and transceivers) - CAN FD: up to 5 Mbit/s (up to 8 Mbit/s depending on wiring and transceivers)
LIN channels	1x LIN 7269cap Bitrates - Normal-Mode: up to 20 kBit/s - Flash-Mode: up to 115.2 kBit/s (depending on wiring higher bitrates are possible) Ext. supply voltage (between pin 7269cap VB- and 7269cap VB+): max. 36 V DC.
K-Line channels	1
Time stamps	Accuracy (within one device): 1 µs Accuracy software sync: typ. 50 µs
Temperature range	Operating: -40 °C...+70 °C Shipping and storage: -40 °C...+85 °C
Relative humidity of ambient air	15 %...95 %, non-condensing
Dimensions (LxWxH)	65 mm x 42 mm x 20 mm
Weight	80 g
Operating system requirements	Windows 10 (x64, 64 bit) Windows 11 (x64, 64 bit)

2.3.5 Accessories



Reference
Information on available accessories can be found in the separate accessories manual on our website.

Cables and connectors

- CANcable0
- CANcable1
- CANcableA
- CANcable Y
- CANcable 2Y
- CANterm 120
- CANcable Set Pro
- USBadapter 3.2 Gen 1 C-A SDSL (Single Screw Lock)

2.4 VN1630A

2.4.1 Scope of Delivery

Contents

The delivery includes:

- VN1630A CAN/LIN Interface
- USB2.0 cable (part number 05011)
- USB Protector Type 1 (part number 05142, see page 70)

2.4.2 Main Features

VN1630A features

The main features of the VN1630A interface are:

- 2x CAN high-speed 1051cap transceiver (capacitively decoupled)
- 2x additional plug-in location for CAN-/LINpiggies
- Fifth channel for dedicated digital-analog input/output tasks
- Five LEDs indicating bus activities and status
- Software sync
- Hardware sync (via SYNCcableXL)



Figure 6: VN1630A CAN/LIN Interface

2.4.3 Connectors Bus Side

Device connectors

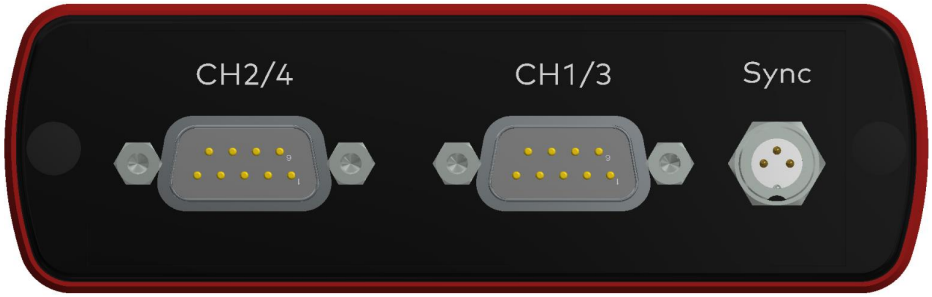


Figure 7: VN1630A with D-SUB9 connectors and sync

- **Binder connector (Sync)**
  This connector (Binder type 711) can be used for time synchronization of different Vector devices (see section Time Synchronization on page 125). **The sync connector is not intended to connect a power supply.**

Pin	Assignment
1	Not connected
2	Synchronization line
3	Ground



- **D-SUB9 (CH1/3 and CH2/4)**
  The VN1630A has two D-SUB9 connectors, each with up to two channels (CAN/CAN or LIN/CAN). Further information on the pin assignment for CH1/CH3 and CH2/CH4 can be found in section Pin Assignment CH1/3 and CH2/4 on page 26.

2.4.4 Connectors USB Side

Device connectors

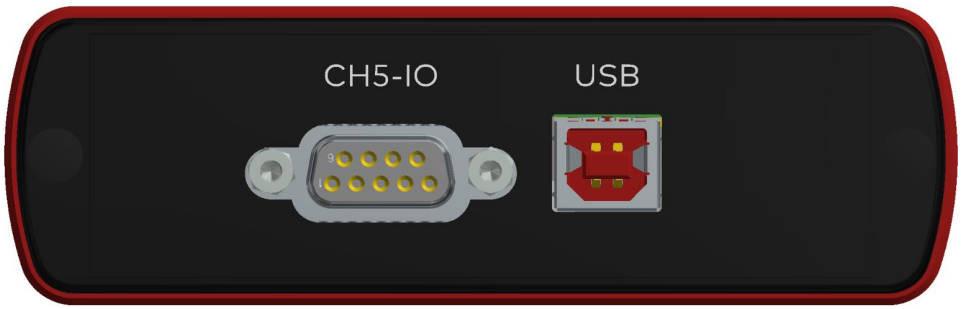


Figure 8: VN1630A with D-SUB9 connector and USB

- **USB**
  Connect your computer and the VN1630A via USB to install and to use the device with measurement applications (e. g. CANoe, CANalyzer). Use the USB2.0 compliant cable found in the delivery (USB extension cables may generate faults between the computer and the device). Connect the device directly to USB at your computer or use a USB hub with its own power supply (self-powered). Depending on the used piggyback, the VN1630A requires the entire USB current (500 mA) which cannot be provided by a bus-powered USB hub.

- **D-SUB9 (CH5)**
  The VN1630A has a D-SUB9 connector (CH5) for dedicated digital-analog input/output tasks. The pin assignment can be found in section Pin Assignment CH5 on page 29.

2.4.5 LEDs

Description

The VN1630A has five LEDs indicating bus activities and status:

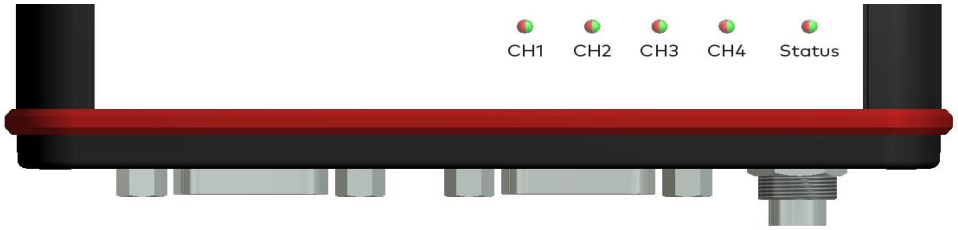


Figure 9: LEDs of the VN1630A

- **CH1 … CH4 (with CAN-/LINpiggies)**
  Multicolored channel LEDs, each indicating the bus activity for CAN, LIN or K-Line.

Color	Description
Green	Data frames have been sent or received correctly.
Orange	CAN: Error frames have been sent or received. LIN/K-Line: Protocol errors as well as valid messages on the bus.
Red	CAN: Bus off. LIN/K-Line: Protocol errors on the bus.

CAN: The flashing frequency depends on the bus load.

- **Status**
  Multicolored LED that indicates the status of the device.

Color	Description
Green	Device is ready for operation/running measurement.
Orange	Initializing driver. Please wait.
Red	Error. Device not working.

2.4.6 Bus Configuration

Piggybacks for CH1 and CH2

The VN1630A has two piggyback plug-in locations (primary channels CH1 and CH2). Depending on requirements, electrically decoupled CAN High-Speed, CAN Low-Speed, CAN Single Wire, J1708 or LIN transceivers may be used. In addition, two electrically decoupled built-in CAN TJA1051 (high-speed) transceivers are available (secondary channels CH3 and CH4). CH5 is reserved for dedicated IO tasks.

Note
A list of compatible piggybacks can be found in the accessories manual or on our website.

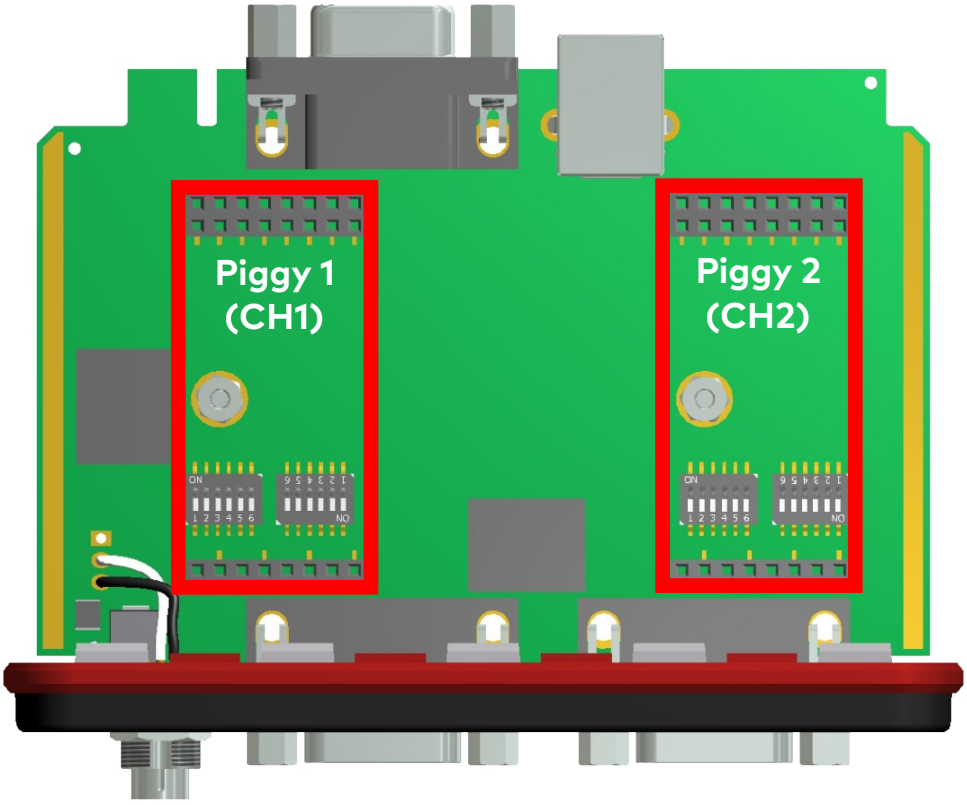


Figure 10: Piggyback plug-in locations for CH1 and CH2

Note
LINpiggies have to be inserted before CANpiggies (in ascending order). If you intend to use only one LINpiggy, please use the first plug-in location (CH1). J1708 should be handled like CAN.

Each empty plug-in location is loaded with a built-in transceiver from the secondary channel according to the DIP switch settings.

Reference
Further information on DIP switches can be found in section Pin Assignment CH1/3 and CH2/4 on page 26.

Piggyback order

Primary	CH1	CH2
Piggyback		

Secondary	CH3	CH4
Built-in Transceiver	CAN 1051cap	CAN 1051cap

Examples

The following tables show examples of possible configurations:

2x CAN without piggybacks 1x IO

	 CH1/CH3	 CH2/CH4	 CH5
Piggyback	-	-	-
Primary	**CH1**	**CH2**	**CH5**
	⬆	⬆	
Built-in Transceiver	CAN 1051cap	CAN 1051cap	
Secondary	CH3	CH4	

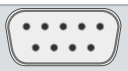
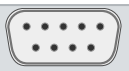
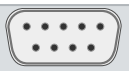
Configuration
CH1: no piggyback, built-in CAN 1051cap transceiver (CH3).
CH3: not usable.
CH2: no piggyback, built-in CAN 1051cap transceiver (CH4).
CH4: not usable.
CH5: on-board IO.

4x CAN 1x IO

	 CH1/CH3	 CH2/CH4	 CH5
Piggyback	CAN	CAN	-
Primary	**CH1**	**CH2**	**CH5**
	-	-	
Built-in Transceiver	CAN 1051cap	CAN 1051cap	
Secondary	**CH3**	**CH4**	

Configuration
CH1: CANpiggy.
CH3: built-in CAN 1051cap transceiver.
CH2: CANpiggy.
CH4: built-in CAN 1051cap transceiver.
CH5: on-board IO.

1x LIN
2x CAN
1x IO

	 CH1/CH3	 CH2/CH4	 CH5
Piggyback	LIN	-	-
Primary	**CH1**	**CH2**	**CH5**
	-	⬆	
Built-in Transceiver	CAN 1051cap	CAN 1051cap	
Secondary	**CH3**	CH4	

Configuration
CH1: LINpiggy.
CH3: built-in CAN 1051cap transceiver.
CH2: no piggyback, built-in CAN 1051cap transceiver (CH4).
CH4: not usable.
CH5: on-board IO.

2.4.7 Pin Assignment CH1/3 and CH2/4

Double assignment of D-SUB9 connectors CH1 and CH2

Before installing a piggyback in the plug-in location (see section Replacing Piggybacks on page 31), the pin assignment of the D-SUB9 connector (CH1/CH3 and CH2/CH4) has to be selected via DIP switches, which can be found inside the device at the plug-in locations.

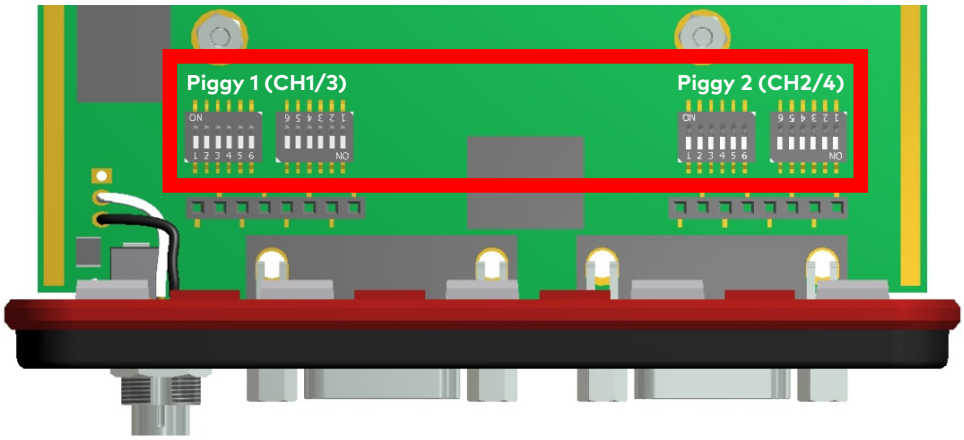


Figure 11: DIP switches (left: CH1/3, right: CH2/4)

Pin assignment CH1 … CH4

The pin assignments of the D-SUB9 connectors depend on the used bus transceiver configuration inside the VN1630A. A list of compatible piggybacks can be found in the accessories manual or on our website.

► **No piggyback inserted**

If no piggyback is inserted, only the built-in CAN transceiver at CH1 (CH2) is active (no double assignment of the D-SUB9 connector):

Pin	Assignment
1	Not connected
2	1051cap CAN Low
3	GND
4	Not connected
5	Shield
6	Not connected
7	1051cap CAN High
8	Not connected
9	Not connected

A: all ‚OFF' / B: all ‚ON'

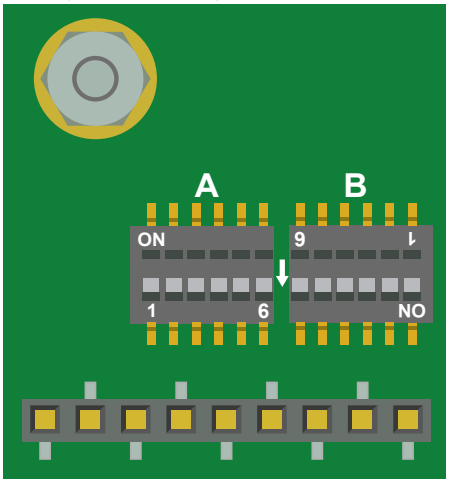
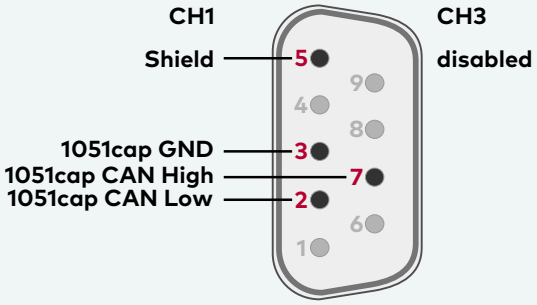


Figure 12: Configuration without piggyback

Example

No piggyback

The following example shows the pin assignment of CH1/CH3 if no piggyback is inserted in the plug-in location at channel 1.



- **CAN/LIN piggyback inserted**

  If a CAN- or LINpiggy is inserted, the piggyback is assigned to CH1 (CH2) and the built-in CAN transceiver is assigned to CH3 (CH4):

Pin	Assignment
1	1051cap CAN Low
2	Piggyback-dependent
3	Piggyback-dependent
4	Piggyback-dependent
5	Shield
6	GND
7	Piggyback-dependent
8	1051cap CAN High
9	Piggyback-dependent

A: all ‚ON' / B: all ‚OFF'

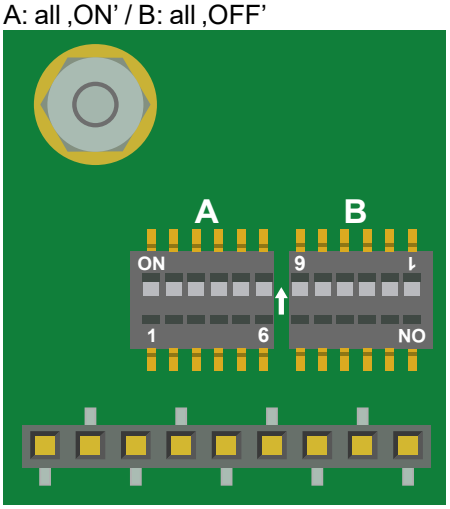
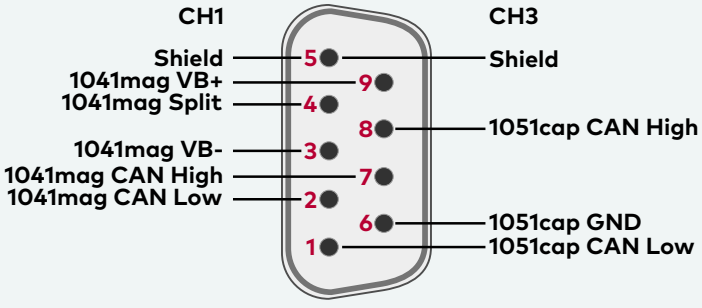


Figure 13: Configuration with piggyback

Example

CANpiggy 1041mag

The following example shows the pin assignment of CH1/CH3 if a CANpiggy 1041mag is inserted in the plug-in location at channel 1.



Note
The described pin assignment is also valid for CH2/CH4. A warning appears in the **Vector Hardware Manager** (page **Device Properties**, **Status** mode), if the DIP switch settings are improperly set. Check your DIP switch settings in this case.

CAN/LIN Y cable

Use the CANcable 2Y to access both channels on separate D-SUB9 connectors (see accessories manual, part number 05075). The pin assignments of the D-SUB9 connectors depend on the used bus transceiver configuration inside the VN1630A. A list of compatible piggybacks can be found in the accessories manual or on our website.

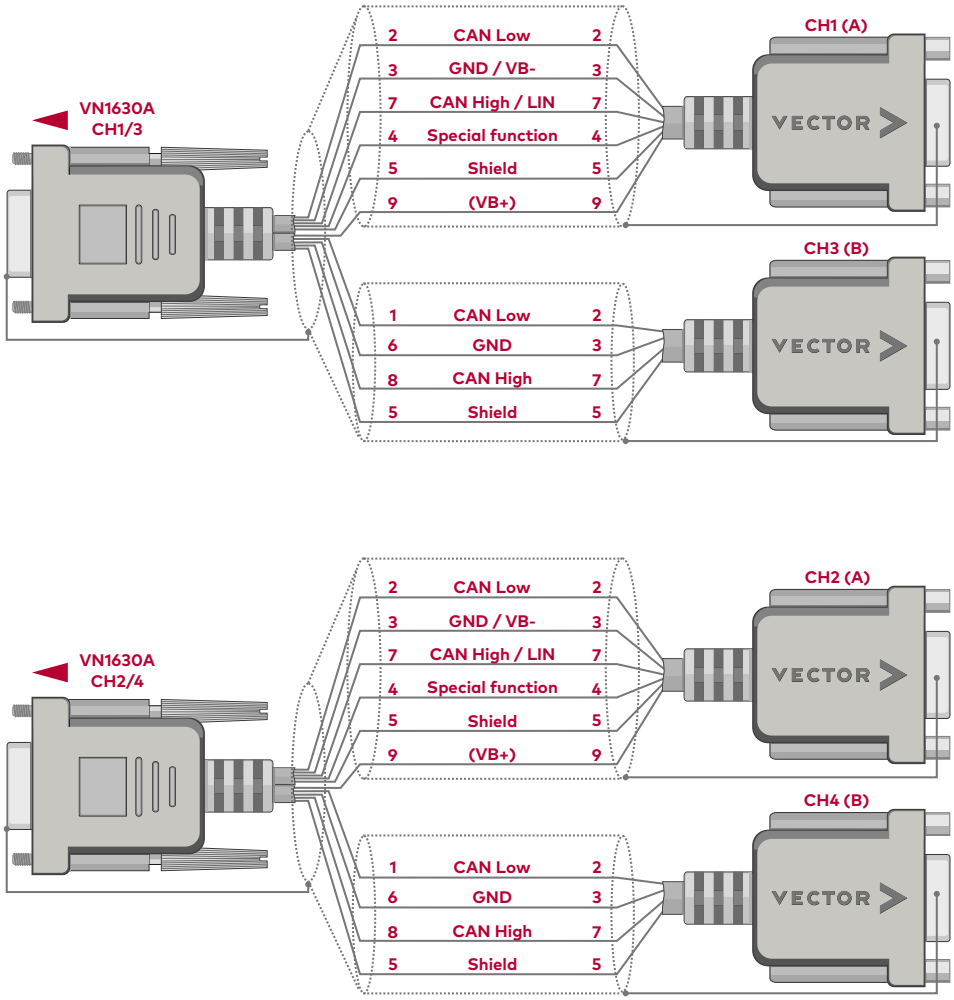


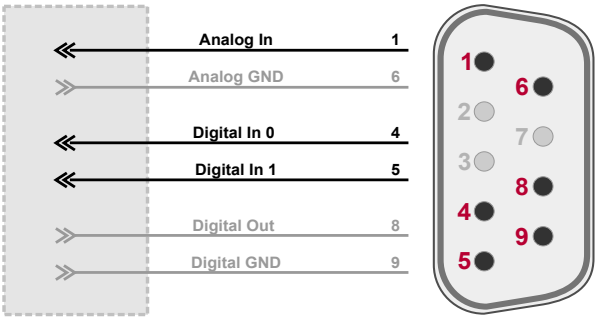
Figure 14: 2x CANcable 2Y connected to VN1630A

2.4.8 Pin Assignment CH5

Digital/analog IO

The pin assignment for CH5 is as follows:

Pin	Assignment
1	Analog input
2	Not connected
3	Not connected
4	Digital input 0
5	Digital input 1
6	Analog GND
7	Not connected
8	Digital output
9	Digital GND



Internal interconnection of digital input 0/1

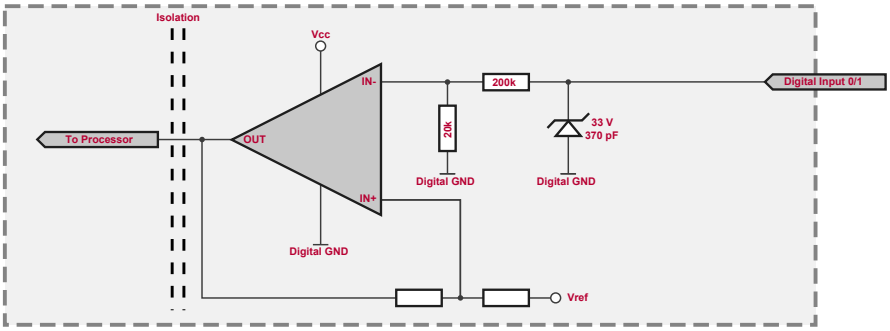


Figure 15: Digital input 0/1

Internal interconnection of digital output

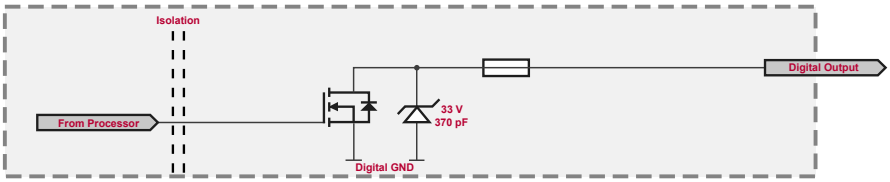


Figure 16: Digital output

Internal interconnection of analog input

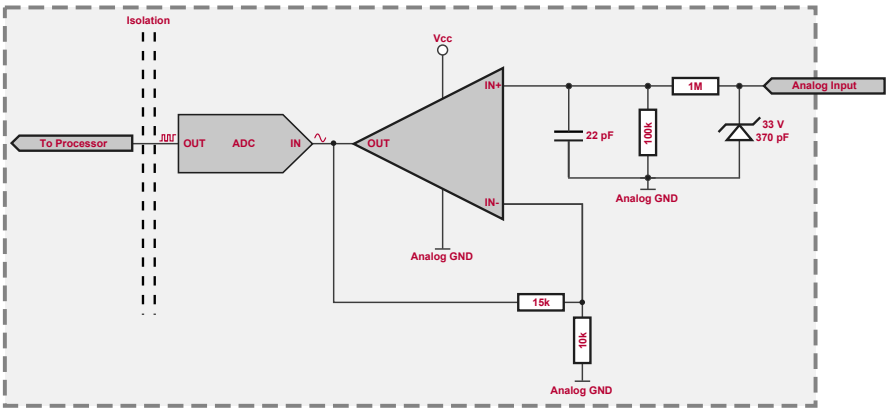


Figure 17: Analog input

Extended measuring range of the analog input

In normal operation, voltages up to 18 V can be applied and measured at the analog input. The cutoff frequency f_c (-3 dB) for AC voltages is approx. 7.2 kHz.

For measurements above 18 V (max. 50 V), an external series resistor has to be applied to the analog input. The series resistor R_{ext} depends on the input voltage U_{input} and can be calculated as follows:

$$R_{ext}\,[kOhm] = [(U_{input} * 0.61111) - 11] * 100$$
$$with\ 18\,V < U_{input} \leq 50\,V$$

The cutoff frequency for AC voltages is also affected by the external series resistor:

$$f_c\left[Hz\right] = \frac{1}{2.33 * 10^{-6} * R_{ext}\,[kOhm]}$$

Examples

	24 V	32 V	36 V	48 V
R_{ext}	367 kΩ	856 kΩ	1100 kΩ	1833 kΩ
R_{ext} (E96)	374 kΩ (24.12 V)	866 kΩ (32.17 V)	1100 kΩ (36.00 V)	1870 kΩ (48.60 V)
f_c (-3 dB)	1148 Hz	496 Hz	390 Hz	230 Hz

2.4.9 Replacing Piggybacks

Caution!
Ensure an ESD safe working environment during disassembly and assembly. Avoid touching the top, bottom or connectors of the boards during this process to avoid ESD damage.

Step by Step Procedure

1. First, loosen the VN1630A housing screws on the side with the two D-SUB9 connectors. This requires removing the two black decorative caps. Then carefully pull the PC-board out of the housing.

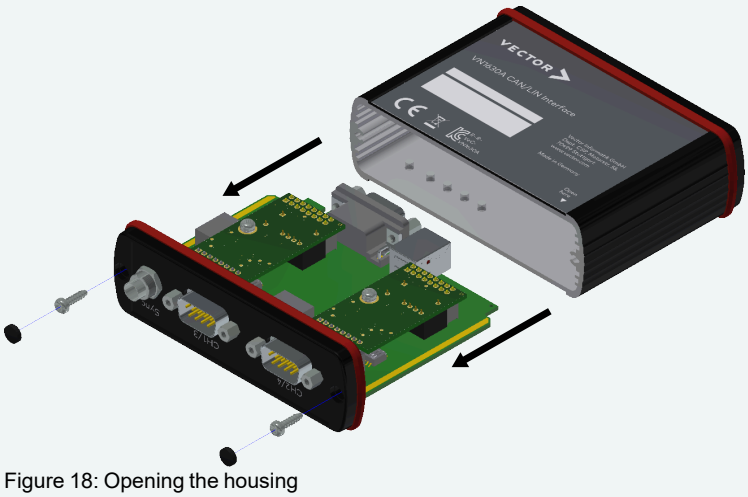


Figure 18: Opening the housing

2. You will find the plug-in location 1 (CH1) at the sync connector side and plug-in location 2 (CH2) at the edge of the PC-board.

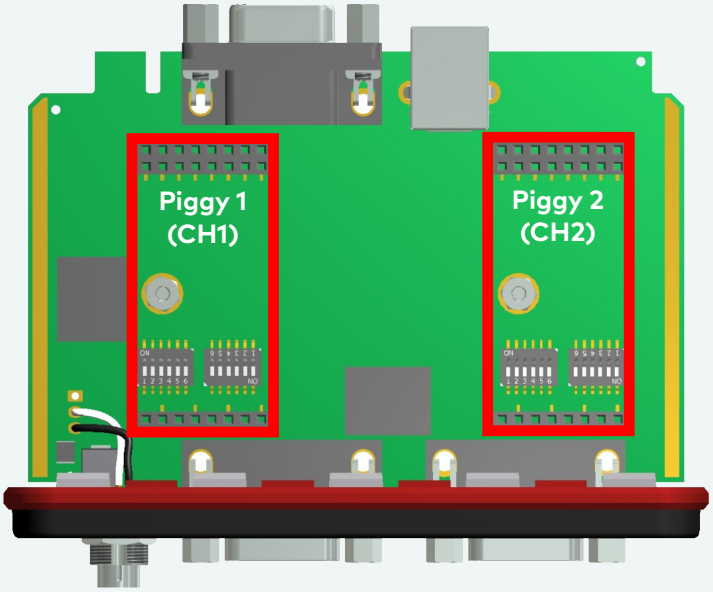


Figure 19: Piggyback plug-in locations CH1 and CH2

3. Each piggyback is fastened by a screw and retainer. Please loosen the appropriate screw including the retainer and carefully remove the piggyback from the plug-in location.

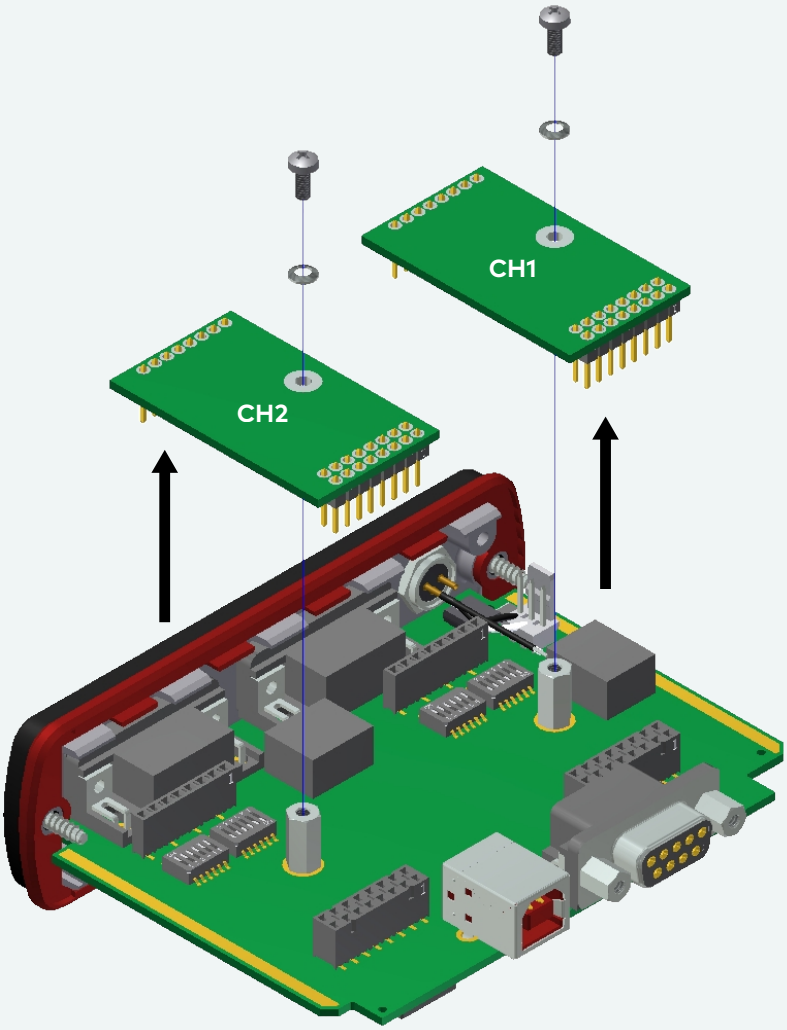


Figure 20: Unmount/mount piggybacks

4. Set the DIP switches as described in section Pin Assignment CH1/3 and CH2/4 on page 26.
5. Insert the replacement piggyback. When doing this please make sure that the single and dual-row connectors are not laterally offset.
6. Secure the new piggyback with the appropriate screw and retainer.

7. Place the VN1630A main board back in the housing. This operation involves placing the housing on a table with its back side (side with the bar code) facing upward. Then the main board with the piggybacks facing upward is inserted into the second guide rails.

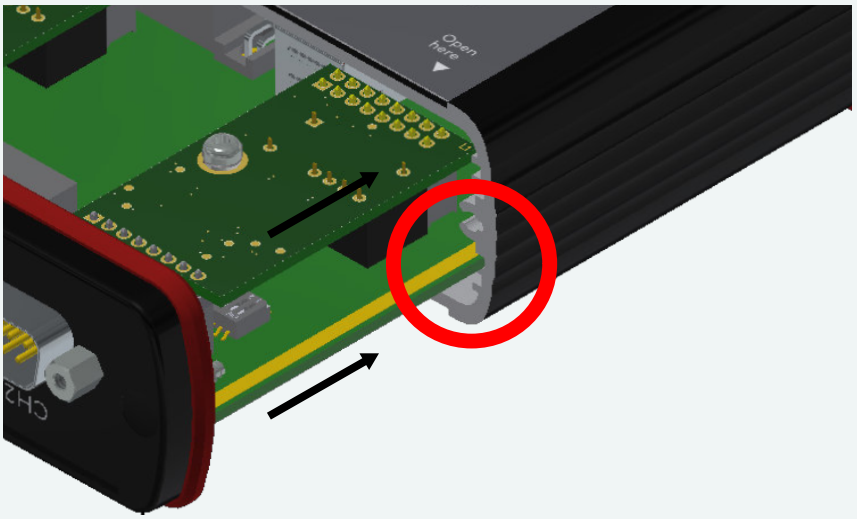


Figure 21: Second guide rails

8. It should be possible to slide the main board in the housing up to a few millimeters from the end without forcing it in. Close the housing by applying light pressure and then secure it with the appropriate screw fasteners. The screws should be secure but not excessively tight.
9. Please also attach the two black decorative caps.
10. Connect the VN1630A and the computer via the USB cable and check the bus configuration in the **Vector Hardware Manager** (page **Device Properties**, **Status** mode).

2.4.10 Technical Data

CAN channels	Max. 4 2x CAN high-speed 1051cap 2x configurable via piggybacks Bitrates - CAN: up to 1 Mbit/s (up to 2 Mbit/s depending on wiring and transceivers) - CAN FD: up to 5 Mbit/s (up to 8 Mbit/s depending on wiring and transceivers)
LIN channels	Max. 2 configurable via piggybacks Bitrates - Normal-Mode: up to 20 kBit/s - Flash-Mode: up to 115.2 kBit/s (depending on wiring higher bitrates are possible)
K-Line channels	Max. 2 with LINpiggy 7269mag at CH1/CH2
J1708 channels	Max. 2 configurable via piggybacks
Analog input	10 bit Input 0 V...18 V Voltage tolerance up to 50 V (with series resistor) Sampling rate up to 1 kHz
Digital input	Range 0 V...32 V Schmitt trigger high 2.7 V, low 2.2 V Hysteresis 0.5 V Input frequencies up to 1 kHz
Digital output	Open Drain External supply up to 32 V Current max. 500 mA Short circuit / over voltage protected
Time stamps	Accuracy (within one device): 1 µs Accuracy software sync: typ. 50 µs Accuracy hardware sync: typ. 1 µs
Power consumption	Approx. 2.5 W
Temperature range	Operating: -40 °C...+70 °C Shipping and storage: -40 °C...+85 °C
Relative humidity of ambient air	15 %...95 %, non-condensing
Dimensions (LxWxH)	Approx. 90 mm x 110 mm x 35 mm
Weight	230 g (without accessories)
Operating system requirements	Windows 10 (x64, 64 bit) Windows 11 (x64, 64 bit)

2.4.11 USB Protector Type 1

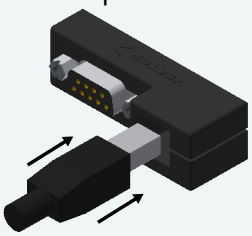
To protect the USB connector of VN1630A or VN1640A against mechanical damages, the USB Protector Type 1 (part number 05142) can be used. The USB Protector Type 1 is part of the standard delivery of VN1630A and VN1640A and available as accessory, too.



Step by Step Procedure

The following steps describe the mounting of the USB Protector:

1. Insert the USB cable into the USB Protector. Therefore, loosen the screw of the clamp.



2. Attach the USB Protector to the Vector network interface and connect the D-SUB9 connector as well as the USB connector.



3. Tighten the screws of the D-SUB9 connector.
4. Tighten the screw to fix the USB connector.

2.4.12 Accessories



Reference
Information on available accessories can be found in the separate accessories manual on our website.

Bus transceiver

- CAN-/LINpiggies
- J1708 Piggyback

Cables and connectors

- CANcable0
- CANcable1
- CANcableA
- CANcable TnT
- CANcable Y
- CANcable 2Y
- CANterm 120
- CANcable Set Pro
- Vector SYNCcableXL
- Vector SYNCcable50
- Multi SYNCbox external
- Multi SYNCbox active
- Cable Binder 3pol Connector with Pigtail
- USB Cable 2.0

Miscellaneous

- Fix Kit 32mm Device
- USB Protector Type 1

2.5 VN1630 log

2.5.1 Main Features

VN1630 log features

The main features of the VN1630 log interface are:

- 2x CAN high-speed 1051cap transceiver (capacitively decoupled)
- 2x additional plug-in location for CAN-/LINpiggies
- Fifth channel for dedicated digital-analog input/output tasks
- LEDs indicating bus activities and status
- Software sync
- Hardware sync (via SYNCcableXL)

The recording features are:

- Recording data of CAN, CAN FD, LIN, digital and analog inputs
- Data storage on SD/SDHC card
- Separate LED for logging status
- Filter and Trigger symbolically configurable
- Real time clock for date/time information
- External power supply for standalone mode



Figure 22: VN1630 log CAN/LIN Interface

2.5.2 Connectors Bus Side

Device connectors

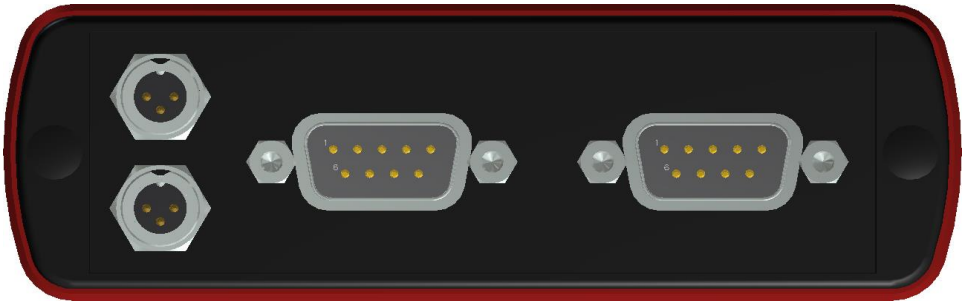


Figure 23: VN1630 log with sync and D-SUB9 connectors

- **Power/hardware sync connector**
  The VN1630 log has two identical power/sync connectors (Binder type 711) which can be used for power or in Interface Mode for time synchronization of different Vector devices (see section Time Synchronization on page 125). It does not matter which connector is used to supply the device.

Pin	Assignment
1	Power supply (typ. 12 V)
2	Synchronization line (for Interface Mode)
3	Ground



- **D-SUB9 (CH1/3 and CH2/4)**
  The VN1630 log has two D-SUB9 connectors, each with up to two channels (CAN/CAN or LIN/CAN). Further information on the pin assignment for CH1/CH3 and CH2/CH4 can be found in section Pin Assignment CH1/3 and CH2/4 on page 46.

Caution!
It is recommended to connect the VN1630 log to the same voltage supply (e. g. battery of the vehicle) as the vehicle or test equipment. If two different voltage supplies are being used for the VN1630 log and the test equipment, the ground (GND) pins of the two voltage supplies must be connected.

2.5.3 Connectors USB Side

Device connectors

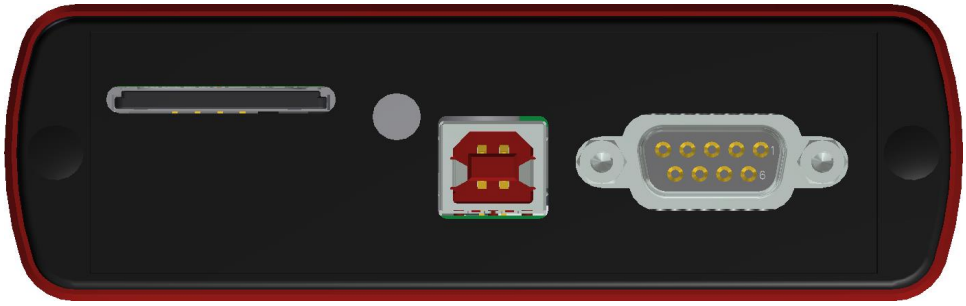


Figure 24: VN1630 log with SD card slot, LED push-button, USB and D-SUB9 connector

- **SD card slot**
  The VN1630 log has a push-and-pull card holder in which the SD card is inserted and removed. To insert a SD card push it until it latches in place securely. To securely remove the SD card, press the LED push button at least for three seconds. Remaining data in the ring buffer is copied to the SD card which can take approx. 15 seconds. During this time, the LED flashes yellow. Remove the SD card only if the LED lights green. During this sequence the VN1630 log must not be disconnected from the power supply. This protects the SD card from memory losses. Then unlatch the SD card by pushing it into the holder slot. Remove the card.

Caution!
To avoid mechanical damage do not pull the SD card from the card holder forcefully.

- **LED push button**
  LED that indicates the SD card status.

Color	Description
Green	SD card can be removed.
Yellow	On: SD card inserted and identified. Do not remove the SD card. Flashing: Logging in progress. Do not remove the SD card.

- **USB**
  Connect your computer and the VN1630 log via USB to install, to configure and to use the device with measurement applications (e. g. CANoe, CANalyzer). Use the USB2.0 compliant cable found in the delivery (USB extension cables may generate faults between the computer and the device). Connect the device directly to USB at your computer or use a USB hub with its own power supply (self-powered). Depending on the used piggyback, the VN1630 log requires the entire USB current (500 mA) which cannot be provided by a bus-powered USB hub. The VN1630 log also supports two operating modes which can be switched by using the USB connection and power supply respectively:

Mode	USB	External Power Supply
Interface Mode/ Logging configuration	connected to computer	optional
Logging Mode	not connected	yes

Interface Mode

In Interface Mode, the VN1630 log operates as a CAN/LIN interface between a computer and the bus. Messages can be received and sent over both channels with suitable tools (identical to VN1630A). The VN1630 log must be in the Interface Mode to configure the logging mode.

While used as interface by a Vector tool, recorded data can be read from the SD card. In this case the interface functionality has priority and the card access takes places with reduced speed.

Logging Mode

The Logging Mode enables the computer independent usage of the VN1630 log and allows the logging of CAN and LIN events. For this purpose, the VN1630 log must be unplugged from the USB connector of the computer and externally supplied via the Binder connector.

Caution!
During logging, the VN1630 log must not be connected to the computer via the USB cable, since the logging mode would otherwise be exited!

Reference
Information on the configuration of the logging mode can be found in the separate manual provided with the **Vector Logger Suite** on the Vector Driver Disk in `\Tools\VN1630_log`.

- **D-SUB9 (CH5)**
  The VN1630 log has a D-SUB9 connector (CH5) for dedicated digital-analog input/output tasks. The pin assignment can be found in section Pin Assignment CH5 on page 49.

2.5.4 LEDs

Description

The VN1630 log has five LEDs indicating bus activities and status as well one LED for Logging Mode.

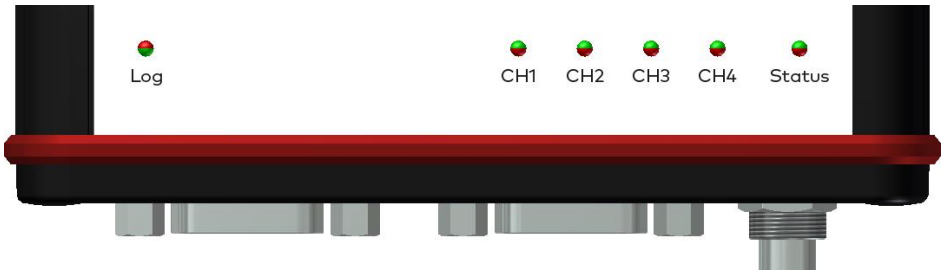


Figure 25: LEDs of the VN1630 log

- **Log**

  Multicolored LED that indicates the status of the logging mode.

Color	Description
Green	Device is accessing the SD card.
Orange	On: SD card full. Flashing: Error while accessing SD card.
Red	Flashing (1 Hz): Piggyback equipment not compatible with logging configuration. Flashing (>1 Hz): Error while logging.

- **CH1 … CH4 (with CAN-/LINpiggies)**

  Multicolored channel LEDs, each indicating the bus activity for CAN, LIN or K-Line.

Color	Description
Green	Data frames have been sent or received correctly.
Orange	CAN: Error frames have been sent or received. LIN/K-Line: Protocol errors as well as valid messages on the bus.
Red	CAN: Bus off. LIN/K-Line: Protocol errors on the bus.

CAN: The flashing frequency depends on the bus load.

- **Status (Interface Mode)**

  Multicolored LED that indicates the status of the device.

Color	Description
Green	Device is ready for operation/running measurement.
Orange	Initializing driver. Please wait.
Red	Error. Device not working.

- **Status (Logging Mode)**
  Multicolored LED that indicates the status of the device.

Color	Description
Green	Device is ready for operation and logging configuration is started.
Orange	Flashing (slow): SD card not inserted. Flashing (fast): Firmware update in progress.
Red	Error. Flashing (slow): Device not working or logging firmware missing. Flashing (fast): Logging configuration missing on SD card or incompatible with firmware.

2.5.5 Bus Configuration

Piggybacks for CH1 and CH2

The VN1630 log has two piggyback plug-in locations (primary channels CH1 and CH2). Depending on requirements, electrically decoupled CAN High-Speed, CAN Low-Speed, CAN Single Wire, J1708 or LIN transceivers may be used. In addition, two electrically decoupled built-in CAN TJA1051 (high-speed) transceivers are available (secondary channels CH3 and CH4). CH5 is reserved for dedicated IO tasks.

Note
A list of compatible piggybacks can be found in the accessories manual or on our website.

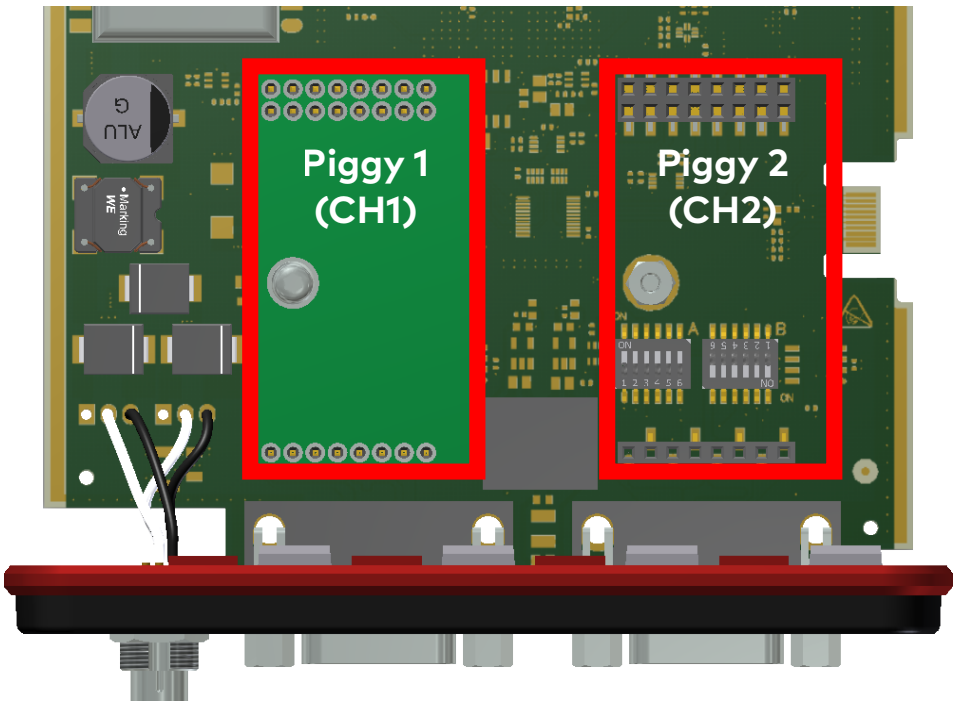


Figure 26: Piggyback plug-in locations for CH1 and CH2

Note
LINpiggies have to be inserted before CANpiggies (in ascending order). If you intend to use only one LINpiggy, please use the first plug-in location (CH1). J1708 should be handled like CAN.

Each empty plug-in location is loaded with a built-in transceiver from the secondary channel according to the DIP switch settings.

Reference
Further information on DIP switches can be found in section Pin Assignment CH1/3 and CH2/4 on page 46.

Piggyback order

Primary	CH1	CH2
Piggyback		

Secondary	CH3	CH4
Built-in Transceiver	CAN 1051cap	CAN 1051cap

Examples

The following tables show examples of possible configurations:

2x CAN without piggybacks 1x IO

	 CH1/CH3	 CH2/CH4	 CH5
Piggyback	-	-	-
Primary	**CH1**	**CH2**	**CH5**
	⬆	⬆	
Built-in Transceiver	CAN 1051cap	CAN 1051cap	
Secondary	CH3	CH4	

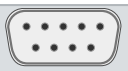
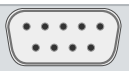
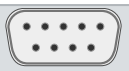
Configuration
CH1: no piggyback, built-in CAN 1051cap transceiver (CH3).
CH3: not usable.
CH2: no piggyback, built-in CAN 1051cap transceiver (CH4).
CH4: not usable.
CH5: on-board IO.

4x CAN 1x IO

	 CH1/CH3	 CH2/CH4	 CH5
Piggyback	CAN	CAN	-
Primary	**CH1**	**CH2**	**CH5**
	-	-	
Built-in Transceiver	CAN 1051cap	CAN 1051cap	
Secondary	**CH3**	**CH4**	

Configuration
CH1: CANpiggy.
CH3: built-in CAN 1051cap transceiver.
CH2: CANpiggy.
CH4: built-in CAN 1051cap transceiver.
CH5: on-board IO.

1x LIN
2x CAN
1x IO

	 CH1/CH3	 CH2/CH4	 CH5
Piggyback	LIN	-	-
Primary	**CH1**	**CH2**	**CH5**
	-	⬆	
Built-in Transceiver	CAN 1051cap	CAN 1051cap	
Secondary	**CH3**	CH4	

Configuration
CH1: LINpiggy.
CH3: built-in CAN 1051cap transceiver.
CH2: no piggyback, built-in CAN 1051cap transceiver (CH4).
CH4: not usable.
CH5: on-board IO.

2.5.6 Pin Assignment CH1/3 and CH2/4

Double assignment of D-SUB9 connectors CH1 and CH2

Before installing a piggyback in the plug-in location (see section Replacing Piggybacks on page 51), the pin assignment of the D-SUB9 connector (CH1/CH3 and CH2/CH4) has to be selected via DIP switches, which can be found inside the device at the plug-in locations.

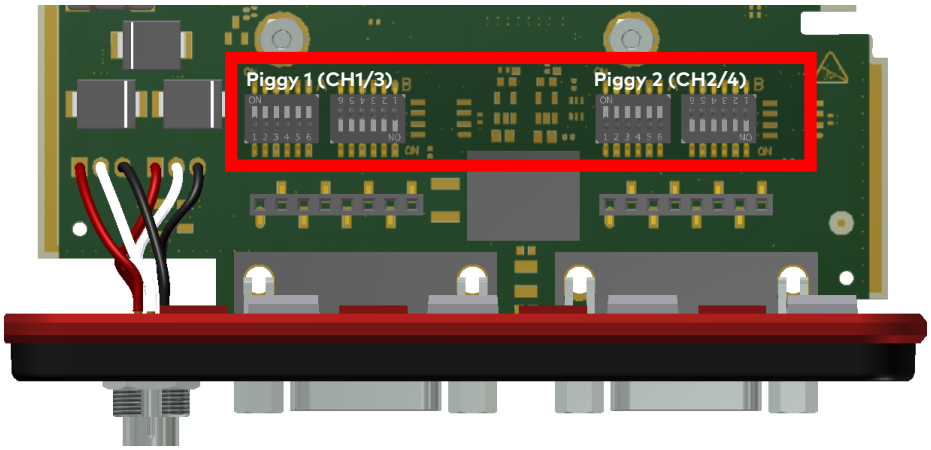


Figure 27: DIP switches (left: CH1/3, right: CH2/4)

Pin assignment CH1 … CH4

The pin assignments of the D-SUB9 connectors depend on the used bus transceiver configuration inside the VN1630 log. A list of compatible piggybacks can be found in the accessories manual or on our website.

- **No piggyback inserted**
  If no piggyback is inserted, only the built-in CAN transceiver at CH1 (CH2) is active (no double assignment of the D-SUB9 connector):

Pin	Assignment
1	Not connected
2	1051cap CAN Low
3	GND
4	Not connected
5	Not connected
6	Not connected
7	1051cap CAN High
8	Not connected
9	Not connected

A: all ‚OFF' / B: all ‚ON'

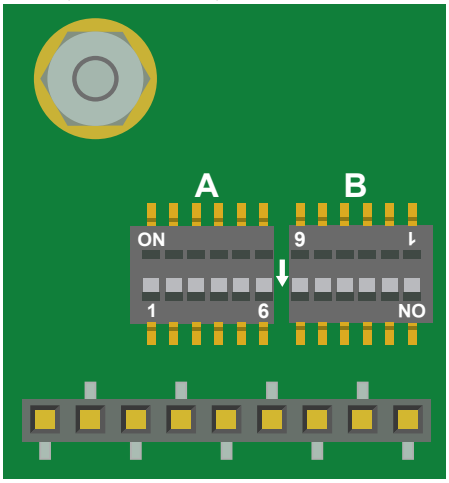
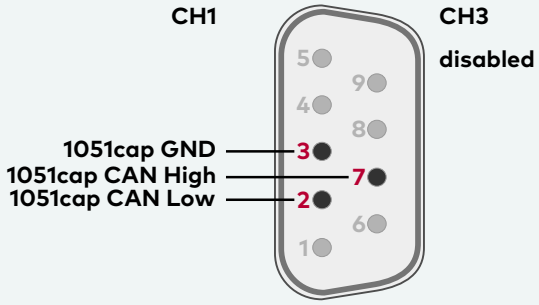


Figure 28: Configuration without piggyback

Example

No piggyback

The following example shows the pin assignment of CH1/CH3 if no piggyback is inserted in the plug-in location at channel 1.



- **CAN/LIN piggyback inserted**

  If a CAN- or LINpiggy is inserted, the piggyback is assigned to CH1 (CH2) and the built-in CAN transceiver is assigned to CH3 (CH4):

Pin	Assignment
1	1051cap CAN Low
2	Piggyback-dependent
3	Piggyback-dependent
4	Piggyback-dependent
5	Not connected
6	GND
7	Piggyback-dependent
8	1051cap CAN High
9	Piggyback-dependent

A: all ‚ON' / B: all ‚OFF'

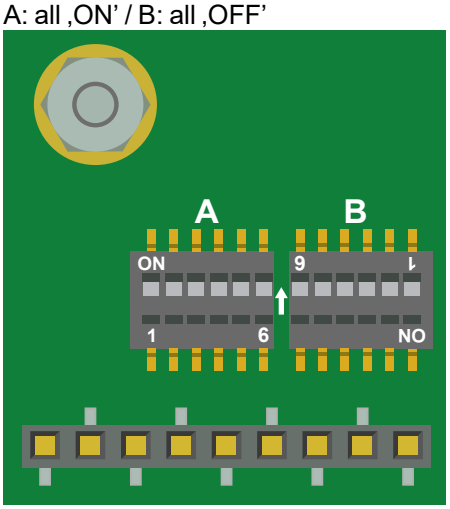
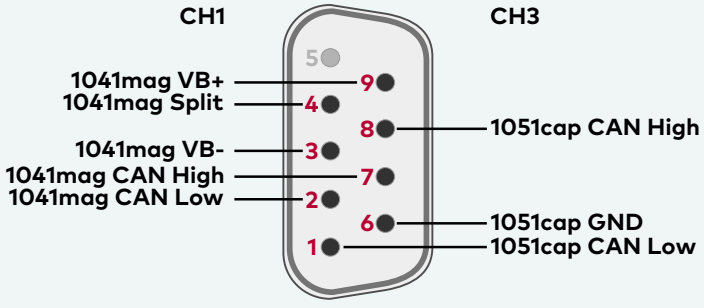


Figure 29: Configuration with piggyback

Example

CANpiggy 1041mag

The following example shows the pin assignment of CH1/CH3 if a CANpiggy 1041mag is inserted in the plug-in location at channel 1.



Note
The described pin assignment is also valid for CH2/CH4. A warning appears in the **Vector Hardware Manager** (page **Device Properties**, **Status** mode), if the DIP switch settings are improperly set. Check your DIP switch settings in this case.

CAN/LIN Y cable

Use the CANcable 2Y to access both channels on separate D-SUB9 connectors (see accessories manual, part number 05075). The pin assignments of the D-SUB9 connectors depend on the used bus transceiver configuration inside the VN1630 log. A list of compatible piggybacks can be found in the accessories manual or on our website.

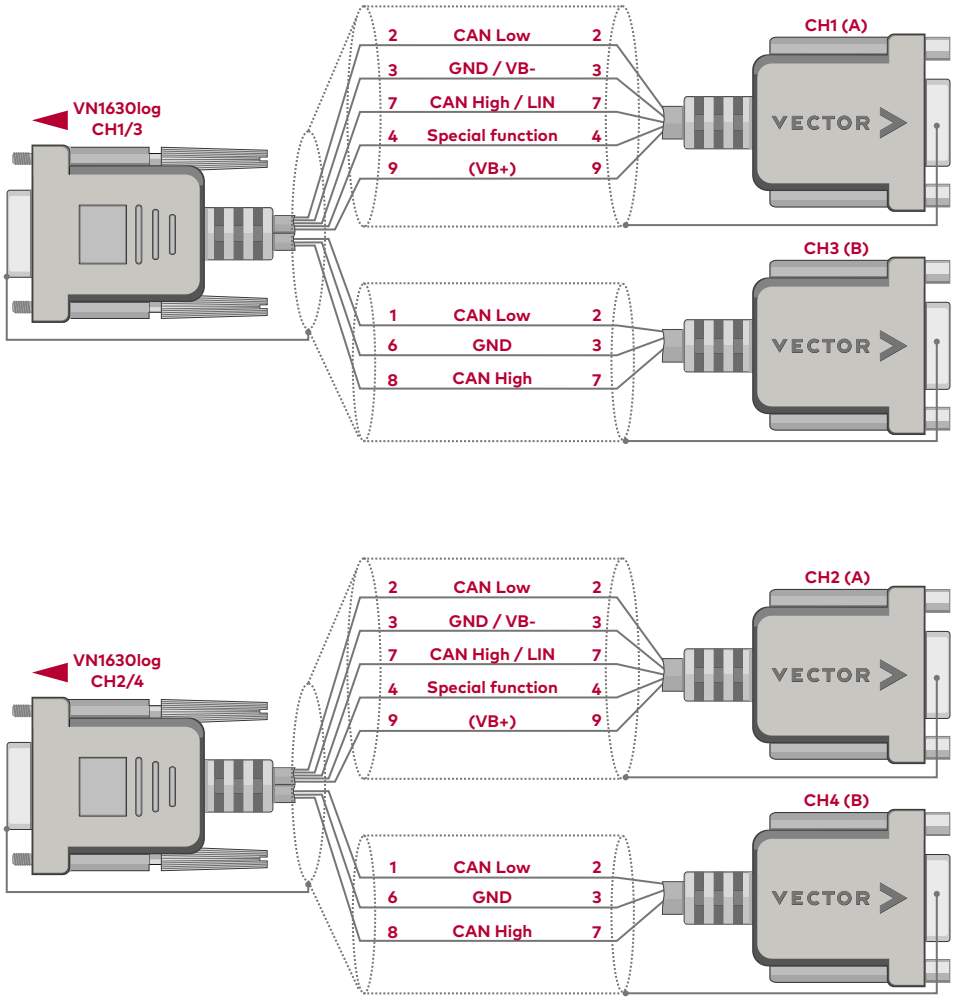


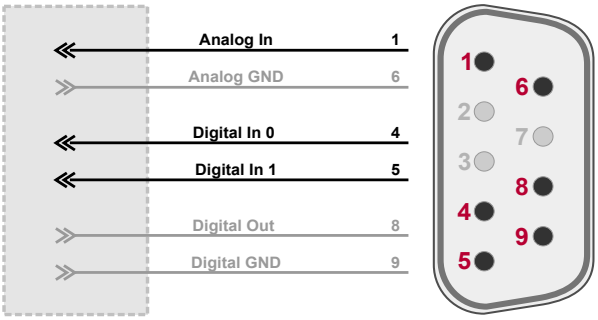
Figure 30: 2x CANcable 2Y connected to VN1630log

2.5.7 Pin Assignment CH5

Digital/analog IO

The pin assignment for CH5 is as follows:

Pin	Assignment
1	Analog input
2	Not connected
3	Not connected
4	Digital input 0
5	Digital input 1
6	Analog GND
7	Not connected
8	Digital output
9	Digital GND



Internal interconnection of digital input 0/1

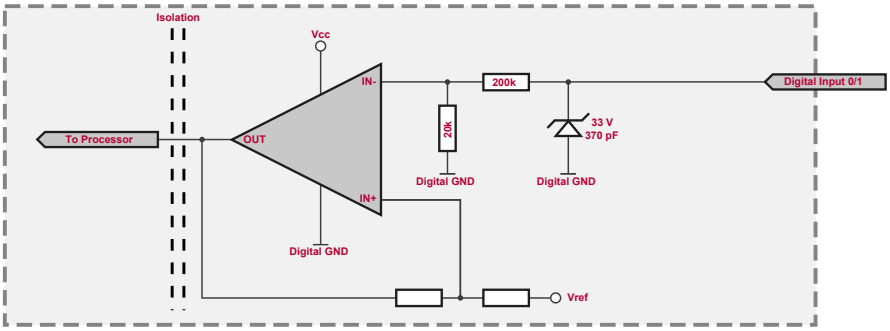


Figure 31: Digital input 0/1

Internal interconnection of digital output

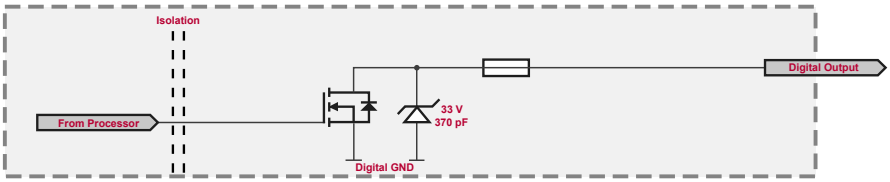


Figure 32: Digital output

Internal interconnection of analog input

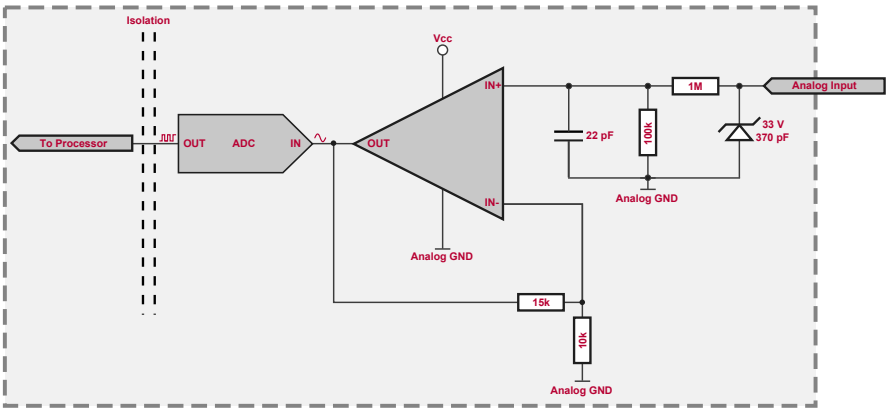


Figure 33: Analog input

Extended measuring range of the analog input

In normal operation, voltages up to 18 V can be applied and measured at the analog input. The cutoff frequency f_c (-3 dB) for AC voltages is approx. 7.2 kHz.

For measurements above 18 V (max. 50 V), an external series resistor has to be applied to the analog input. The series resistor R_{ext} depends on the input voltage U_{input} and can be calculated as follows:

$$R_{ext}\,[kOhm] = [(U_{input} * 0.61111) - 11] * 100$$
$$with\ 18\,V < U_{input} \leq 50\,V$$

The cutoff frequency for AC voltages is also affected by the external series resistor:

$$f_c\left[Hz\right] = \frac{1}{2.33 * 10^{-6} * R_{ext}\,[kOhm]}$$

Examples

	24 V	32 V	36 V	48 V
R_{ext}	367 kΩ	856 kΩ	1100 kΩ	1833 kΩ
R_{ext} (E96)	374 kΩ (24.12 V)	866 kΩ (32.17 V)	1100 kΩ (36.00 V)	1870 kΩ (48.60 V)
f_c (-3 dB)	1148 Hz	496 Hz	390 Hz	230 Hz

2.5.8 Replacing Piggybacks

Caution!
Ensure an ESD safe working environment during disassembly and assembly. Avoid touching the top, bottom or connectors of the boards during this process to avoid ESD damage.

Step by Step Procedure

1. First, loosen the VN1630 log housing screws on the side with the two D-SUB9 connectors. This requires removing the two black decorative caps. Then carefully pull the PC-board out of the housing.

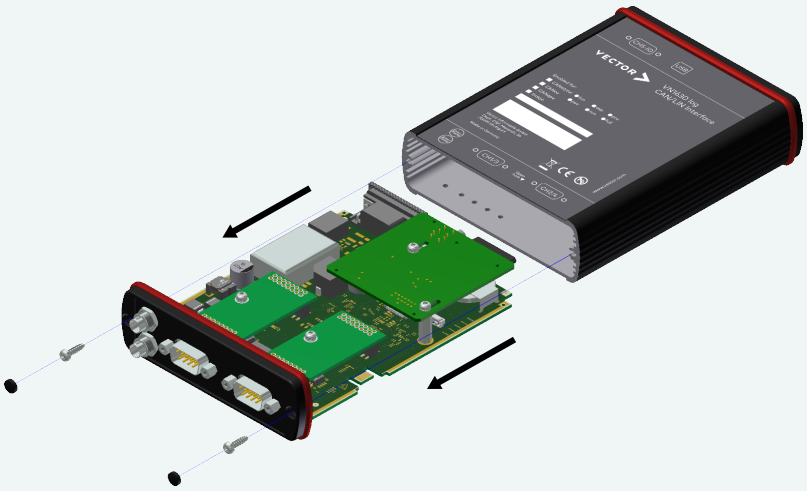


Figure 34: Opening the housing

2. You will find the plug-in location 1 (CH1) at the sync connector side and plug-in location 2 (CH2) at the edge of the PC-board.

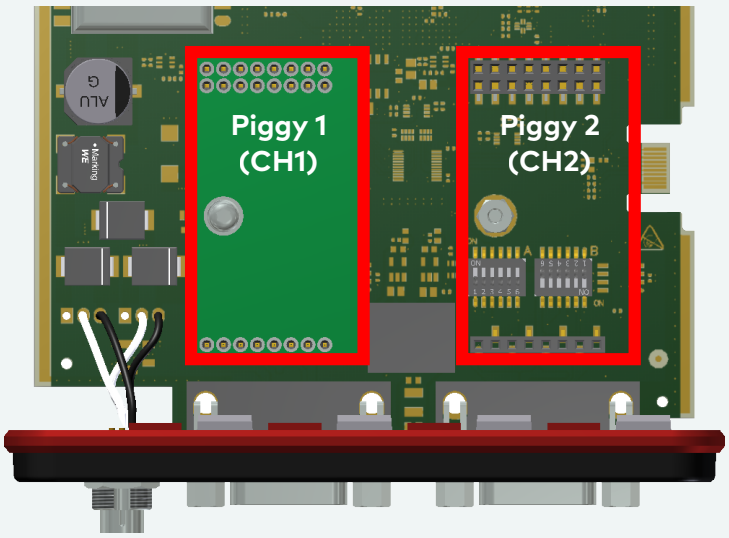


Figure 35: Piggyback plug-in locations CH1 and CH2

3. Each piggyback is fastened by a screw and retainer. Please loosen the appropriate screw including the retainer and carefully remove the piggyback from the plug-in location.

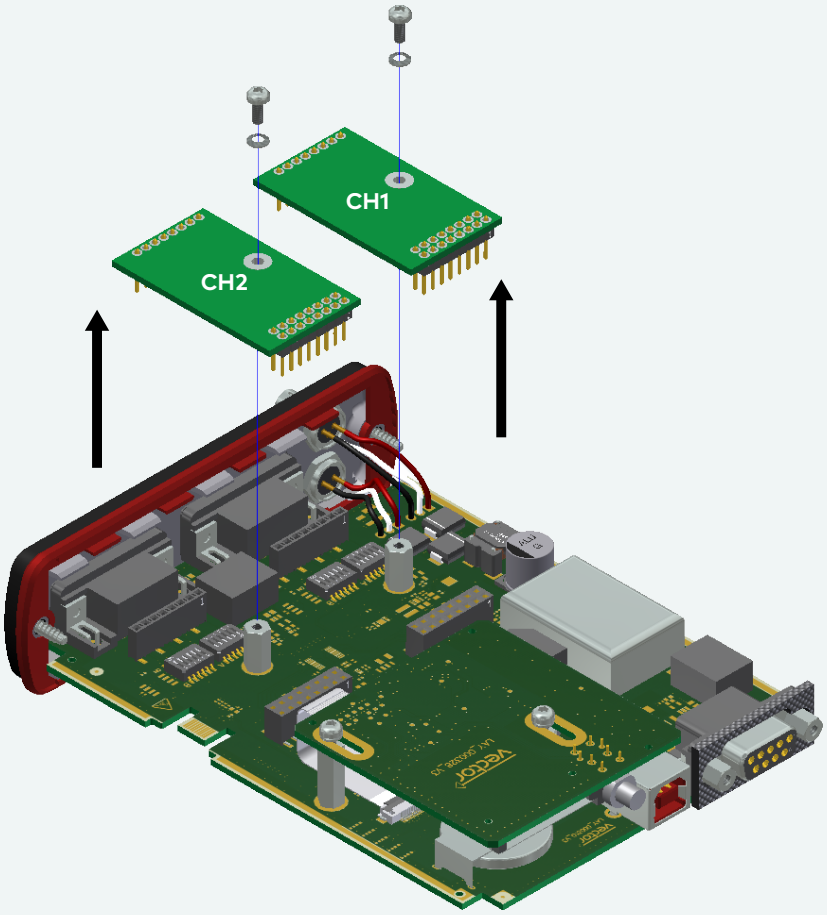


Figure 36: Unmount/mount piggybacks

4. Set the DIP switches as described in section Pin Assignment CH1/3 and CH2/4 on page 46.
5. Insert the replacement piggyback. When doing this please make sure that the single and dual-row connectors are not laterally offset.
6. Secure the new piggyback with the appropriate screw and retainer.

7. Place the VN1630 log main board back in the housing. This operation involves placing the housing on a table with its back side (side with the bar code) facing upward. Then the main board with the piggybacks facing upward is inserted into the first guide rails.

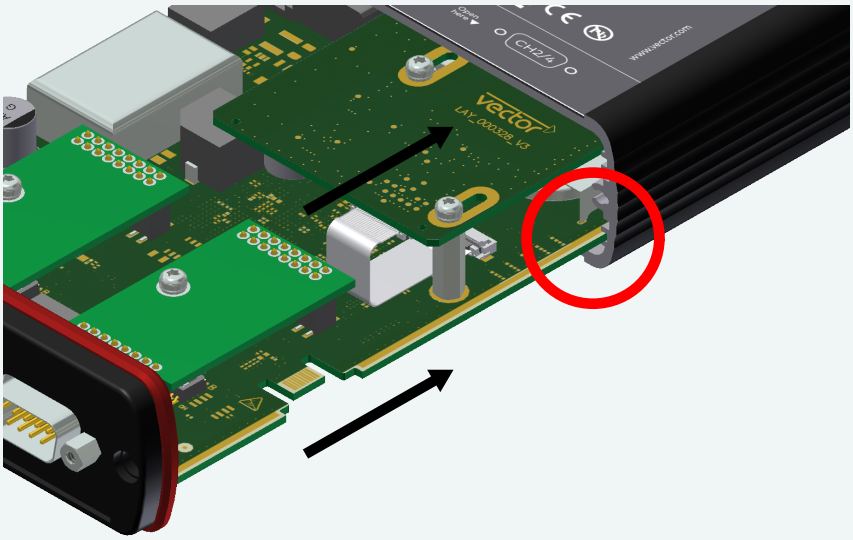


Figure 37: First guide rails

8. It should be possible to slide the main board in the housing up to a few millimeters from the end without forcing it in. Close the housing by applying light pressure and then secure it with the appropriate screw fasteners. The screws should be secure but not excessively tight.
9. Please also attach the two black decorative caps.
10. Connect the VN1630 log and the computer via the USB cable and check the bus configuration in the **Vector Hardware Manager** (page **Device Properties**, **Status** mode).

2.5.9 SD/SDHC Memory Cards

SD/SDHC cards

The VN1630 log supports industrial grade SD/SDHC memory cards up to 32 GB. Recording stops when the memory card is full. This can be configured as error to make the VN1630 log beep.

Only industrial grade SD/SDHC cards approved by Vector are recommended for proper use:

SD/SDHC cards

- Xmore Industrial 2 GB (SD-2G0-XIE82)
- Xmore Industrial 8 GB (SD-8G0-XIE82)
- Xmore Industrial 16 GB (SD-16G-XIE82)
- Xmore Industrial 32 GB (SD032GXQI8C016Z)
- SanDisk Industrial XT 32 GB (SDSDAF-032G-XI)



Note
The memory cards have to be FAT32 formatted. For optimum speed, we recommend FAT32 formatting with the maximum available cluster size.

2.5.10 Ring Buffer in RAM

Memory

The VN1630 log has an allocated ring buffer in its RAM (32 MB) which is used to buffer received data. During recording, the data is continually written to the SD card. When using a triggered recording, the data is only stored into the ring buffer until the trigger event occurs. The data is then copied from the ring buffer to the SD card according to the set pre-trigger time.

2.5.11 Real Time Clock

Description

The VN1630 log has a real time clock for date/time information while logging. The real time clock can be set up in the **Vector Logger Suite**. It is recommended to set the real time clock before first logging.

2.5.12 Battery

Lifetime

The VN1630 log is equipped with a lithium battery that powers the integrated real time clock. The battery has a typical durability of approx. 5 years.

2.5.13 Beep

Beep

The VN1630 log has an acoustic signal generator that alerts the user, for example, in the event of a trigger, overload and full SD card. The desired behavior can be set in the the **Vector Logger Suite**.

2.5.14 Technical Data

CAN channels	Max. 4 2x CAN high-speed 1051cap 2x configurable via piggybacks Bitrates - CAN: up to 1 Mbit/s (up to 2 Mbit/s depending on wiring and transceivers) - CAN FD: up to 5 Mbit/s (up to 8 Mbit/s depending on wiring and transceivers)
LIN channels	Max. 2 configurable via piggybacks Bitrates - Normal-Mode: up to 20 kBit/s - Flash-Mode: up to 115.2 kBit/s (depending on wiring higher bitrates are possible)
K-Line channels	Max. 2 with LINpiggy 7269mag at CH1/CH2
J1708 channels	Max. 2 configurable via piggybacks
Analog input	10 bit Input 0 V...18 V Voltage tolerance up to 50 V (with series resistor) Sampling rate up to 1 kHz
Digital input	Range 0 V...32 V Schmitt trigger high 2.7 V, low 2.2 V Hysteresis 0.5 V Input frequencies up to 1 kHz
Digital output	Open Drain External supply up to 32 V Current max. 500 mA Short circuit / over voltage protected
Time stamps	Accuracy (within one device): 1 µs Accuracy software sync: typ. 50 µs Accuracy hardware sync: typ. 1 µs
Operation mode	Interface and logging
Memory function	Logging on SD/SDHC card
Extras	Real time clock
Startup time (Logging Mode)	3 seconds after power-up
Battery	Lithium primary cell type BR2330A
Power supply	Interface Mode: via USB Logging Mode: 6 V...50 V
Power consumption	Approx. 2.5 W
Temperature range	Operating: -40 °C...+65 °C Shipping and storage: -40 °C...+85 °C
Relative humidity of ambient air	15 %...95 %, non-condensing
Dimensions (LxWxH)	Approx.150 mm x 110 mm x 35 mm
Weight	400 g (without accessories)

Operating system requirements	Windows 10 (x64, 64 bit) Windows 11 (x64, 64 bit)

2.5.15 Accessories



Reference
Information on available accessories can be found in the separate accessories manual on our website.

Bus transceiver

- CAN-/LINpiggies

Cables and connectors

- CANcable0
- CANcable1
- CANcableA
- CANcable TnT
- CANcable TnT Term
- CANcable Y
- CANcable 2Y
- CANterm 120
- CANcable Set Pro
- Vector SYNCcableXL
- Vector SYNCcable50
- Multi SYNCbox external
- Multi SYNCbox active
- Cable Binder 3pol Connector with Pigtail
- USB Cable 2.0

Power supply

- Cable Banana Plug <> Binder 3-pin
- Car Power Supply Cable 12V with Binder

Miscellaneous

- Fix Kit 32mm Device
- SD/SDHC Memory Cards

2.6 VN1640A

2.6.1 Scope of Delivery

Contents

The delivery includes:

- VN1640A CAN/LIN Interface
- USB2.0 cable (part number 05011)
- USB Protector Type 1 (part number 05142, see page 70)

2.6.2 Main Features

VN1640A features

The main features of the VN1640A interface are:

- 4x plug-in location for CAN-, LIN-, K-Line-, J1708- and SENTpiggybacks
- Fifth channel for dedicated digital-analog input/output tasks
- 5x D-SUB9 connector
- Five LEDs indicating bus activities and status
- Software sync
- Hardware sync (via SYNCcableXL)



Figure 38: VN1640A CAN/LIN Interface

2.6.3 Connectors Bus Side

Device connectors

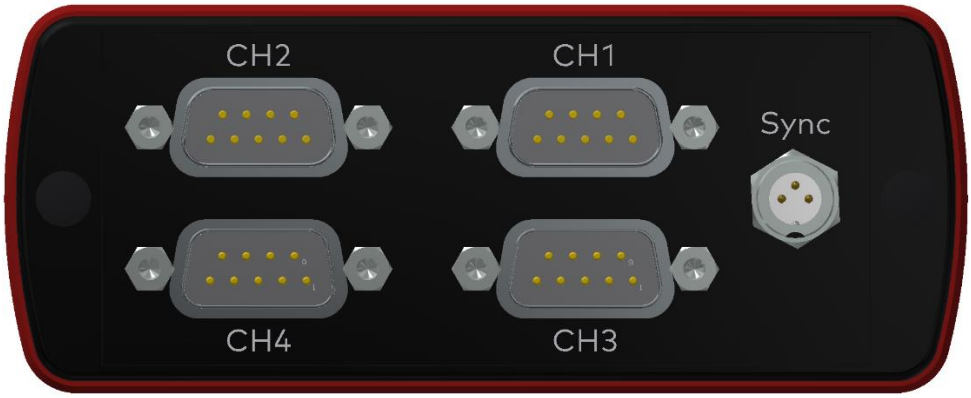


Figure 39: VN1640A with D-SUB9 connectors and sync

- **Binder connector (Sync)**
  This connector (Binder type 711) can be used for time synchronization of different Vector devices (see section Time Synchronization on page 125). **The sync connector is not intended to connect a power supply.**

Pin	Assignment
1	Not connected
2	Synchronization line
3	Ground



- **D-SUB9 (CH1...4)**
  The VN1640A has four D-SUB9 connectors, each assigned to a dedicated piggyback plug-in location. Further information on the pin assignment can be found in section Pin Assignment CH1...CH4 on page 63.

2.6.4 Connectors USB Side

Device connectors

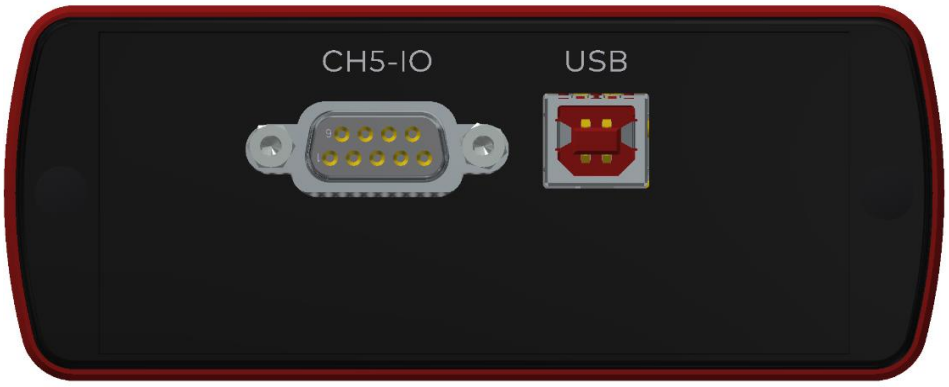


Figure 40: VN1640A with D-SUB9 connector and USB

- **USB**
  Connect your computer and the VN1640A via USB to install and to use the device with measurement applications (e. g. CANoe, CANalyzer). Use the USB2.0 compliant cable found in the delivery (USB extension cables may generate faults between the computer and the device). Connect the device directly to USB at your computer or use a USB hub with its own power supply (self-powered). Depending on the used piggyback, the VN1640A requires the entire USB current (500 mA) which cannot be provided by a bus-powered USB hub.
- **D-SUB9 (CH5)**
  The VN1640A has a D-SUB9 connector (CH5) for dedicated digital-analog input/output tasks. The pin assignment can be found in section Pin Assignment CH5 on page 64.

2.6.5 LEDs

Description

The VN1640A has five LEDs indicating bus activities and status:

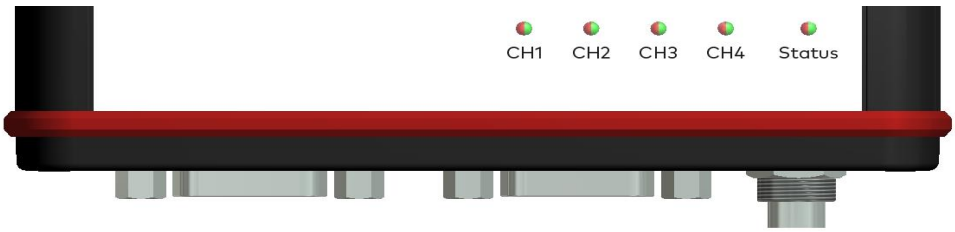


Figure 41: LEDs of the VN1640A

- **CH1 … CH4 (with CAN-/LINpiggies)**
  Multicolored channel LEDs, each indicating the bus activity for CAN, LIN or K-Line.

Color	Description
Green	Data frames have been sent or received correctly.
Orange	CAN: Error frames have been sent or received. LIN/K-Line: Protocol errors as well as valid messages on the bus.
Red	CAN: Bus off. LIN/K-Line: Protocol errors on the bus.

CAN: The flashing frequency depends on the bus load.

- **Status**
  Multicolored LED that indicates the status of the device.

Color	Description
Green	Device is ready for operation/running measurement.
Orange	Initializing driver. Please wait.
Red	Error. Device not working.

2.6.6 Bus Configuration

Piggybacks

The VN1640A has four piggyback plug-in locations (CH1…CH4). Depending on requirements, electrically decoupled CAN High-Speed, CAN Low-Speed, CAN Single Wire, J1708, LIN or SENT transceivers may be used. CH5 is reserved for dedicated IO tasks.

Note
A list of compatible piggybacks can be found in the accessories manual or on our website.

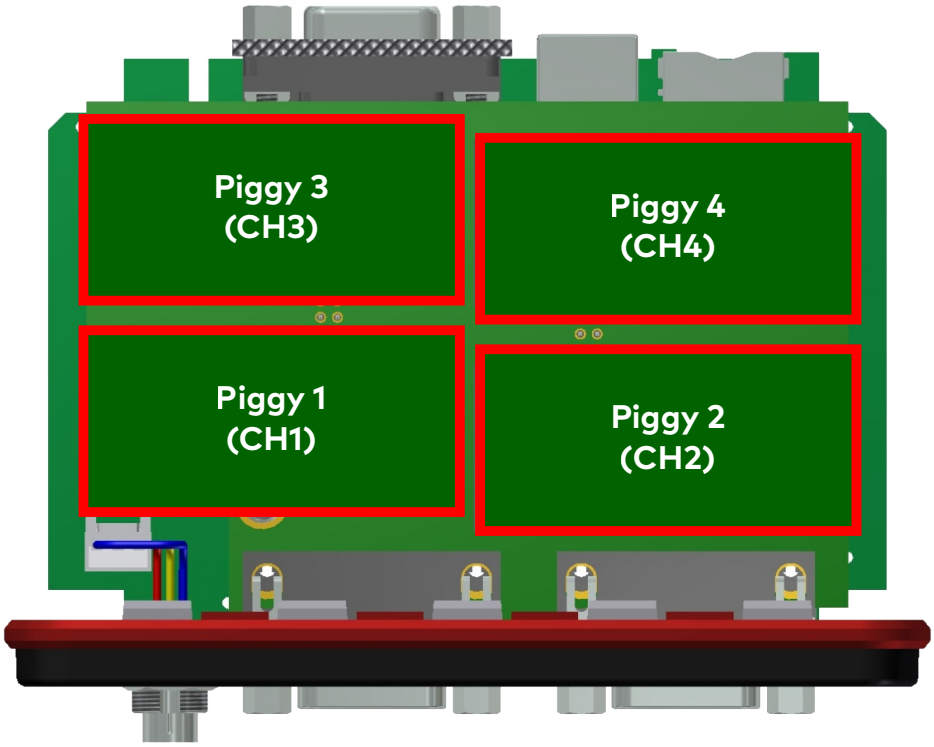


Figure 42: Piggyback plug-in locations for CH1…CH4

Note
LINpiggies have to be inserted before CANpiggies (in ascending order). If you intend to use only one LINpiggy, please use the first plug-in location (CH 1). J1708 should be handled like CAN. SENSORpiggies SENT have to be inserted between LINpiggies and CANpiggies.

Piggyback Configurations			
CH1	**CH2**	**CH3**	**CH4**
CAN1	CAN2	CAN3	CAN4
LIN1	CAN1	CAN2	CAN3
LIN1	LIN2	CAN1	CAN2
LIN1	LIN2	LIN3	CAN1
LIN1	LIN2	LIN3	LIN4

Examples

The following tables show examples of possible configurations:

1x CAN

CH1	CH2	CH3	CH4
CANpiggy 1	-	-	-

1x LIN

CH1	CH2	CH3	CH4
LINpiggy 1	-	-	-

1x LIN
1x CAN

CH1	CH2	CH3	CH4
LINpiggy 1	CANpiggy 1	-	-

1x LIN
1x CAN

CH1	CH2	CH3	CH4
-	LINpiggy 1	-	CANpiggy 1

2x LIN
1x CAN

CH1	CH2	CH3	CH4
LINpiggy 1	LINpiggy 2	CANpiggy 1	-

1x LIN
1x SENT
1x CAN

CH1	CH2	CH3	CH4
LINpiggy 1	SENTpiggy 1	CANpiggy 1	-

1x SENT
1x CAN

CH1	CH2	CH3	CH4
SENTpiggy 1	CANpiggy 1	-	-

1x LIN
1x SENT

CH1	CH2	CH3	CH4
LINpiggy 1	SENTpiggy 1	-	-

2.6.7 Pin Assignment CH1...CH4

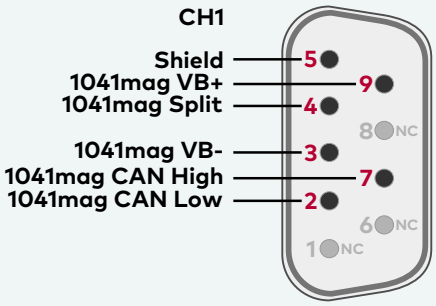
Assignment of the D-SUB9 connectors

The pin assignments depend on the inserted piggybacks. A list of compatible piggybacks can be found in the accessories manual or on our website.

Example

CANpiggy 1041mag

The following example shows the pin assignment of CH1 if a CANpiggy 1041mag is inserted in the plug-in location at channel 1:

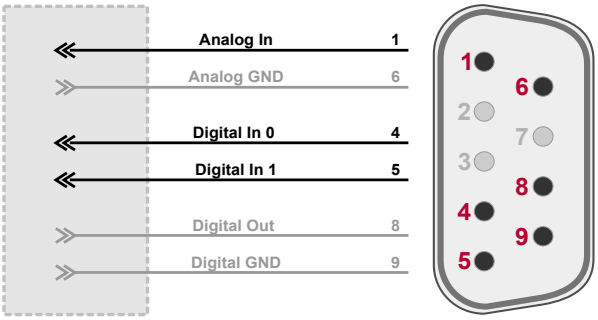


2.6.8 Pin Assignment CH5

Digital/analog IO

The pin assignment for CH5 is as follows:

Pin	Assignment
1	Analog input
2	Not connected
3	Not connected
4	Digital input 0
5	Digital input 1
6	Analog GND
7	Not connected
8	Digital output
9	Digital GND



Internal interconnection of digital input 0/1

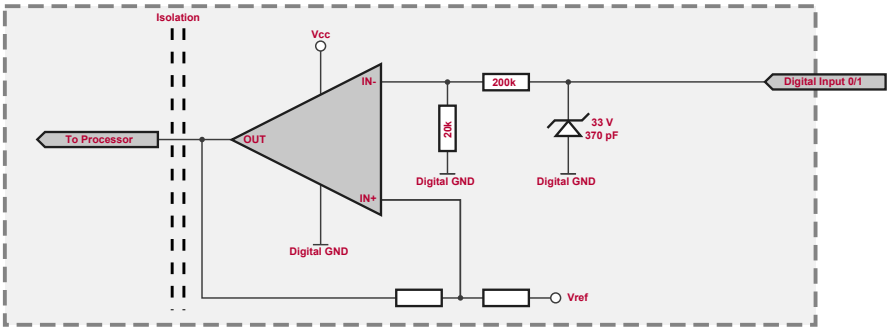


Figure 43: Digital input 0/1

Internal interconnection of digital output

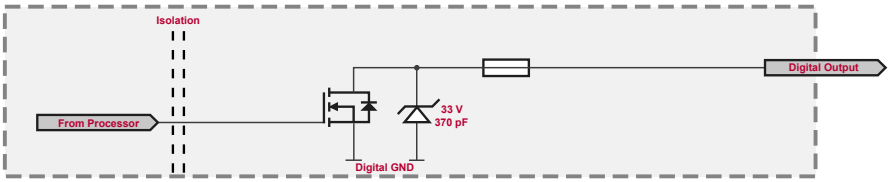


Figure 44: Digital output

Internal interconnection of analog input

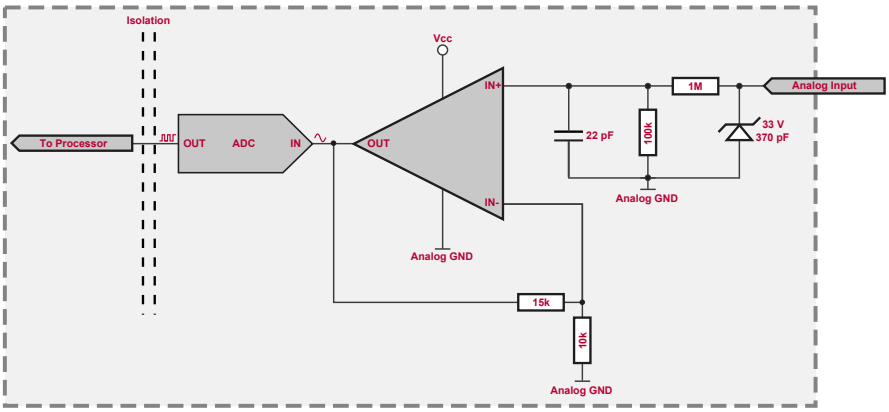


Figure 45: Analog input

Extended measuring range of the analog input

In normal operation, voltages up to 18 V can be applied and measured at the analog input. The cutoff frequency f_c (-3 dB) for AC voltages is approx. 7.2 kHz.

For measurements above 18 V (max. 50 V), an external series resistor has to be applied to the analog input. The series resistor R_{ext} depends on the input voltage U_{input} and can be calculated as follows:

$$R_{ext}\,[kOhm] = [(U_{input} * 0.61111) - 11] * 100$$
$$with\ 18\,V < U_{input} \leq 50\,V$$

The cutoff frequency for AC voltages is also affected by the external series resistor:

$$f_c\left[Hz\right] = \frac{1}{2.33 * 10^{-6} * R_{ext}\,[kOhm]}$$

Examples

	24 V	32 V	36 V	48 V
R_{ext}	367 kΩ	856 kΩ	1100 kΩ	1833 kΩ
R_{ext} (E96)	374 kΩ (24.12 V)	866 kΩ (32.17 V)	1100 kΩ (36.00 V)	1870 kΩ (48.60 V)
f_c (-3 dB)	1148 Hz	496 Hz	390 Hz	230 Hz

2.6.9 Replacing Piggybacks

Caution!
Ensure an ESD safe working environment during disassembly and assembly. Avoid touching the top, bottom or connectors of the boards during this process to avoid ESD damage.

Step by Step Procedure

1. First, loosen the VN1640A housing screws on the side with the four D-SUB9 connectors. This requires removing the two black decorative caps. Then carefully pull the PC-board out of the housing.

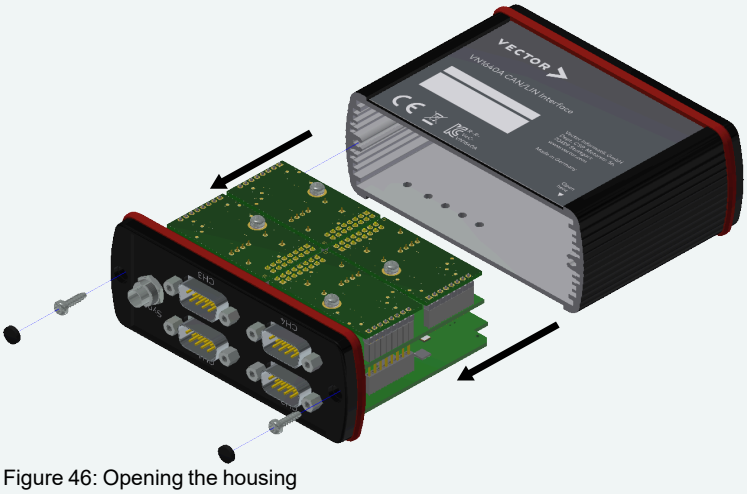


Figure 46: Opening the housing

2. The plug-in locations are defined as follows:

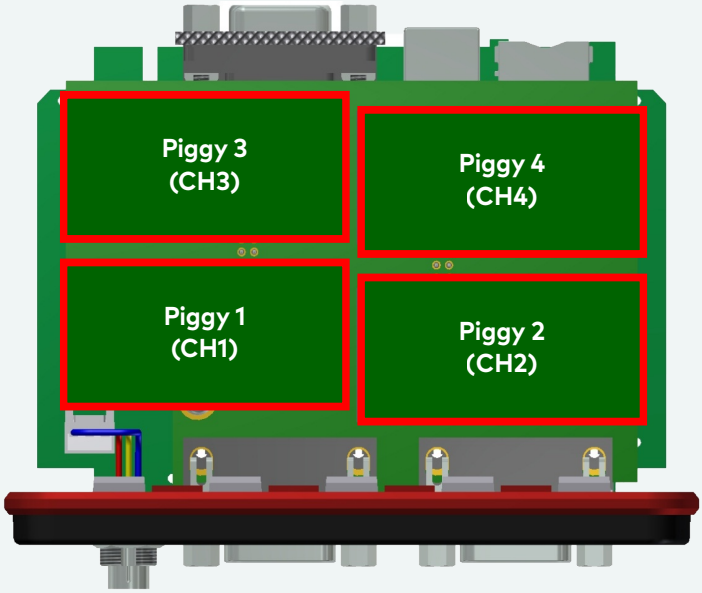


Figure 47: Piggyback plug-in locations CH1…CH4

3. Each piggyback is fastened by a screw and retainer. Please loosen the appropriate screw including the retainer and carefully remove the piggyback from the plug-in location.

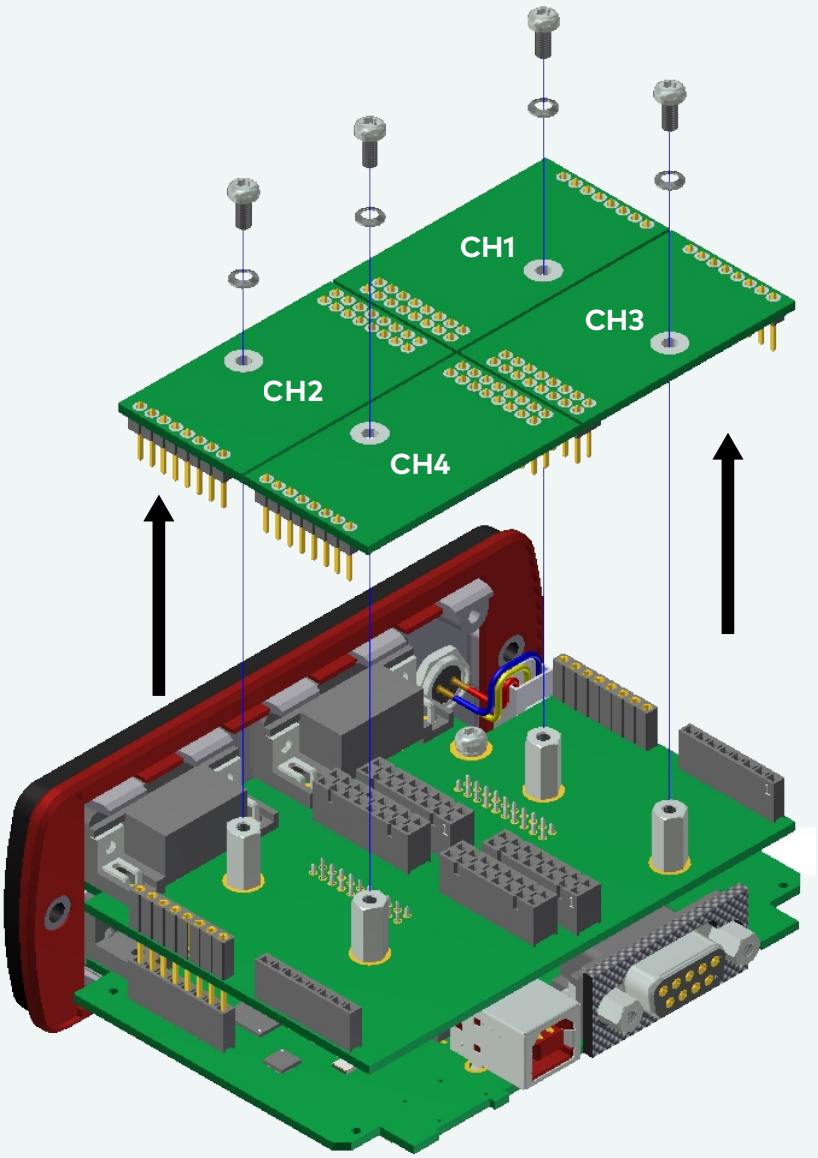


Figure 48: Unmount/mount piggybacks

4. Insert the replacement piggyback. When doing this please make sure that the single and dual-row connectors are not laterally offset.
5. Secure the new piggyback with the appropriate screw and retainer.

6. Place the VN1640A main board back in the housing. This operation involves placing the housing on a table with its back side (side with the bar code) facing upward. Then the main board with the piggybacks facing upward is inserted into the first guide rails.

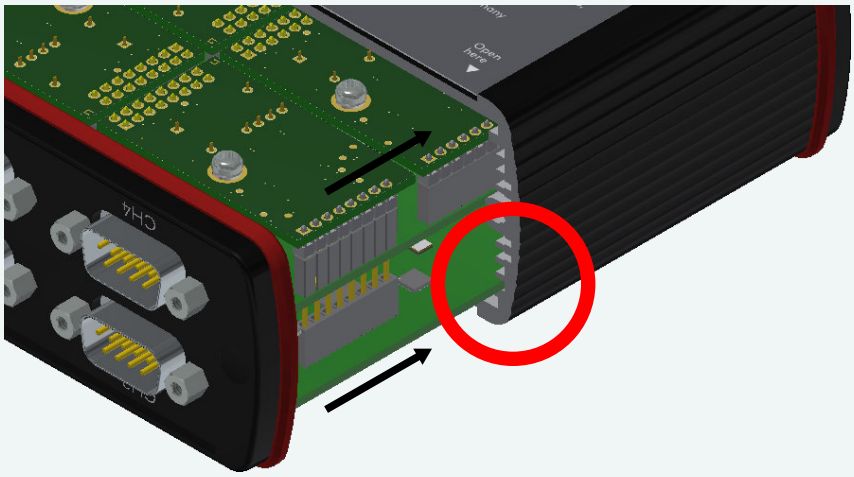


Figure 49: First guide rails

7. It should be possible to slide the main board in the housing up to a few millimeters from the end without forcing it in. Close the housing by applying light pressure and then secure it with the appropriate screw fasteners. The screws should be secure but not excessively tight.
8. Please also attach the two black decorative caps.
9. Connect the VN1640A and the computer via the USB cable and check the bus configuration in the **Vector Hardware Manager** (page **Device Properties**, **Status** mode).

2.6.10 Technical Data

CAN channels	Max. 4 configurable via piggybacks Bitrates - CAN: up to 1 Mbit/s (up to 2 Mbit/s depending on wiring and transceivers) - CAN FD: up to 5 Mbit/s (up to 8 Mbit/s depending on wiring and transceivers)
LIN channels	Max. 4 Bitrates - Normal-Mode: up to 20 kBit/s - Flash-Mode: up to 115.2 kBit/s (depending on wiring higher bitrates are possible)
K-Line channels	Max. 2 with LINpiggy 7269mag at CH1/CH2
J1708 channels	Max. 4 configurable via piggybacks
SENT channels	Max. 2 with SENSORpiggy SENT
Analog input	10 bit Input 0 V...18 V Voltage tolerance up to 50 V (with series resistor) Sampling rate up to 1 kHz
Digital input	Range 0 V...32 V Schmitt trigger high 2.7 V, low 2.2 V Hysteresis 0.5 V Input frequencies up to 1 kHz
Digital output	Open Drain External supply up to 32 V Current max. 500 mA Short circuit / over voltage protected
Time stamps	Accuracy (within one device): 1 µs Accuracy software sync: typ. 50 µs Accuracy hardware sync: typ. 1 µs
Power consumption	Approx. 2.5 W
Temperature range	Operating: -40 °C...+70 °C Shipping and storage: -40 °C...+85 °C
Relative humidity of ambient air	15 %...95 %, non-condensing
Dimensions (LxWxH)	Approx. 88 mm x 111 mm x 45 mm
Weight	330 g (without accessories)
Operating system requirements	Windows 10 (x64, 64 bit) Windows 11 (x64, 64 bit)

2.6.11 USB Protector Type 1

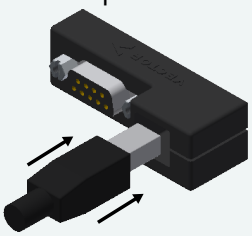
To protect the USB connector of VN1630A or VN1640A against mechanical damages, the USB Protector Type 1 (part number 05142) can be used. The USB Protector Type 1 is part of the standard delivery of VN1630A and VN1640A and available as accessory, too.



Step by Step Procedure

The following steps describe the mounting of the USB Protector:

1. Insert the USB cable into the USB Protector. Therefore, loosen the screw of the clamp.



2. Attach the USB Protector to the Vector network interface and connect the D-SUB9 connector as well as the USB connector.



3. Tighten the screws of the D-SUB9 connector.
4. Tighten the screw to fix the USB connector.

2.6.12 Accessories



Reference
Information on available accessories can be found in the separate accessories manual on our website.

Bus transceiver

- CAN-/LINpiggies
- J1708 Piggyback
- SENT Piggyback

Cables and connectors

- CANcable0
- CANcable1
- CANcableA
- CANcable TnT
- CANcable Y
- CANterm 120
- CANcable Set Pro
- Vector SYNCcableXL
- Vector SYNCcable50
- Multi SYNCbox external
- Multi SYNCbox active
- Cable Binder 3pol Connector with Pigtail
- USB Cable 2.0

Miscellaneous

- Fix Kit 42mm Device
- Protection Kit 1040
- USB Protector Type 1

2.7 VN1641

2.7.1 Scope of Delivery

Contents

The delivery includes:

- VN1641 CAN XL Network Interface
- USB Cable 3.1 Type C-C (Dual Screw Lock, part no. 05141)

2.7.2 Main Features



Figure 50: VN1641 CAN XL Network Interface

VN1641 features

The main features of the VN1641 interface are:

- Support of CAN XL, CAN FD and CAN 2.0
- CAN XL
  - Support of CAN XL Error Signaling Enabled and Error Signaling Disabled
  - Supported on all piggyback channels
- CAN /CAN FD: Support of a Transport Protocol (TP) acceleration
- 4x plug-in location for CANpiggies
  - Dedicated D-SUB9 conncector for each channel
- Digital and anlog inputs and outputs
  - 2x Digital In
  - 1x Digital Out
  - 1x Analog Out
  - Dedicated D-SUB9 conncector
- LEDs indicating bus activities and status
- Synchronization of multiple devices and other bus systems like CAN XL, CAN FD, CAN, LIN, FlexRay, MOST, Ethernet
  - Software time synchronization (with USB host connection)
  - Hardware time synchronization
  - IEEE1588 – PTP (with Ethernet host connection)
- Host connection
  - USB 3.2 Gen. 1 with USB Type-C and screwable connector
  - Ethernet Host Connection (Gigabit Ethernet 1000BASE-T)
- Powered via USB Type-C connector

- Configurable temperature limit to avoid device overheating (configurable via Vector Hardware Manager)
- Transparent integration into the Vector tools (CANoe/CANalyzer, CANape, vFlash, ...)
- Licensor: provides Vector licenses (USB host connection only)
- Multi-application support for CAN XL/CAN FD/CAN channels: different tools can use one channel at the same time
- Operating temperature range: -40 °C...+55 °C
- Kensington Lock: possibility to secure the VN1641 with a Kensington NanoSaver®
- Functional Earth for optional connection of housing ground to system ground

2.7.3 Connectors Front Side

Device connectors

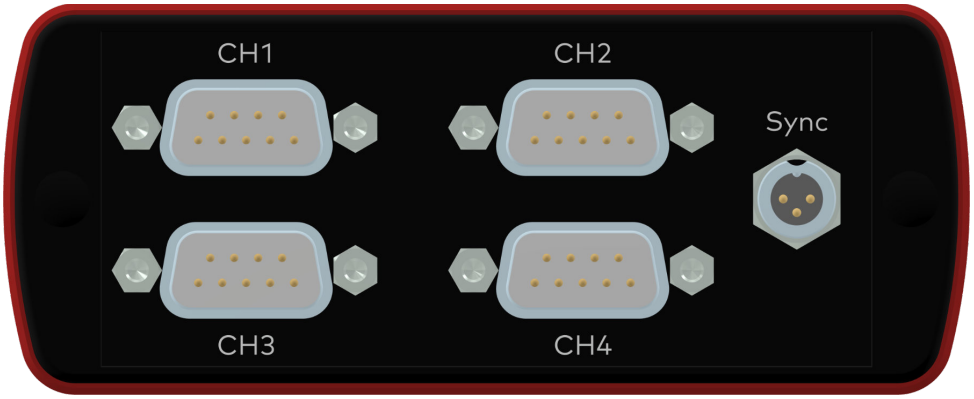


Figure 51: VN1641 connectorson the front

- **D-SUB9 (CH1...4)**
  The VN1641 has four D-SUB9 connectors, each assigned to a dedicated piggy-back plug-in location. Further information on the pin assignment can be found in section Pin Assignment CH1...CH4 on page 80.

- **Binder connector (Sync)**
  This connector (Binder type 711) can be used for time synchronization of different Vector devices (see section Time Synchronization on page 125). **The sync connector is not intended to connect a power supply.**

Pin	Assignment
1	Not connected
2	Synchronization line
3	Ground



2.7.4 Connectors Back Side

Device connectors

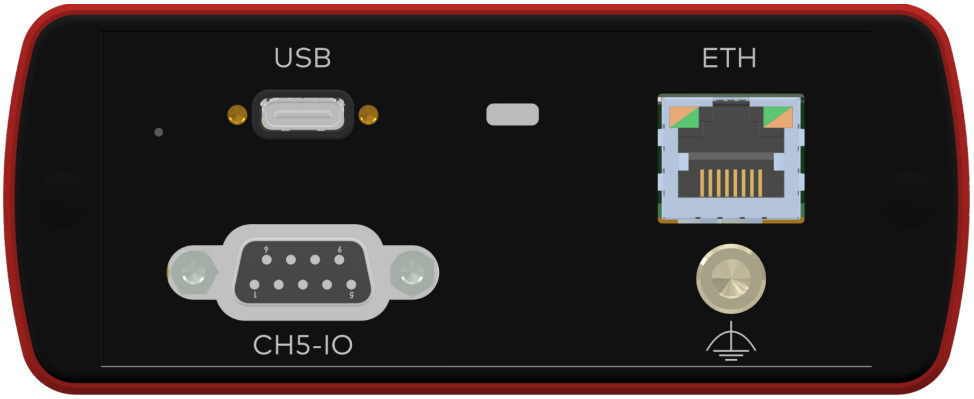


Figure 52: VN1641 connectors on the back

- **Reset**
  If the device configuration is corrupted, start it with pushed reset button. The reset button is located to the left of the USB port.
- **USB**
  Connect your computer to the VN1641 via USB Type-C to use it with measurement applications (e. g. CANoe, CANalyzer) and to power it. For more details on the power supply, please refer to section Power Supply Options on page 76.
- **Kensington Lock**
  Mounting of Nano Kensington (NanoSaver).
- **ETH (RJ45 connector)**
  Connect your computer and the VN1641 via 100BASE-TX or 1000BASE-T to use the device with applications (e. g. CANoe, CANalyzer). The device must be powered from a USB Type-C power supply when using the Ethernet host connection (see section Power Supply Options on page 76).
- **D-SUB9 (CH5)**
  The VN1641 has a D-SUB9 connector (CH5) for dedicated digital-analog input/output tasks. The pin assignment can be found in section Pin Assignment CH5 on page 81.
- **Functional Earth (FE)**
  Optional connection of housing ground to system ground.

2.7.5 Power Supply Options

The VN1641 is powered via USB Type-C, regardless of whether it is connected to the host via USB or Ethernet. Some examples of how to power the VN1641 are given below.

USB host connection

The VN1641 is USB bus powered when the USB host connection is used. This requires a USB 3.1 Gen. 1 USB Type-C port on the host that provides 7.5 W (1.5 A @ 5 V) or more power. A USB 3.1 Gen.1 Type C-C cable (included) must be used.

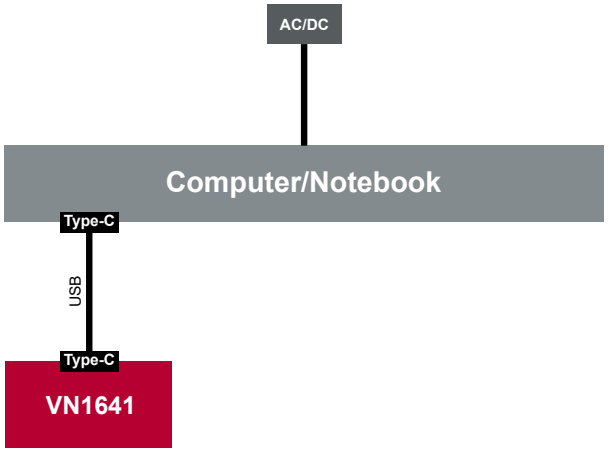


Figure 53: Power supply via host (directly)

Note

The VN1641 can only be used with a USB 3.1 Gen. 1 Type C-C cable that complies with the USB Type-C specification. Type A-C USB cables or any adapter cable cannot be used as they do not provide enough power.

If the USB port does not provide enough power, the status LED will light red.

The VN1641 can be used with a USB 3 hub if the hub provides a USB 3.1 Gen. 1 Type-C port with 7.5 W (1.5 A @ 5 V) or more. This usually requires an externally powered hub. Vector offers a suitable hub as an accessory.

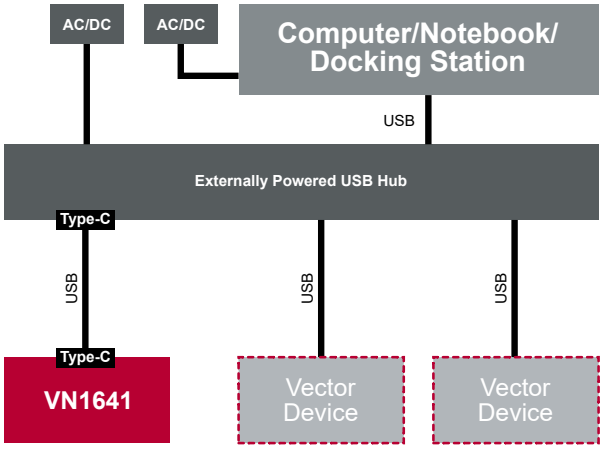


Figure 54: USB 3 hub with external power supply

Ethernet host connection

If the VN1641 is connected to the computer via Ethernet, the VN1641 requires an external USB Type-C power supply. Any standard USB Type-C power supply rated at 7.5 W (1.5 A @ 5 V) or higher can be used. Vector offers a suitable power supply as an accessory.

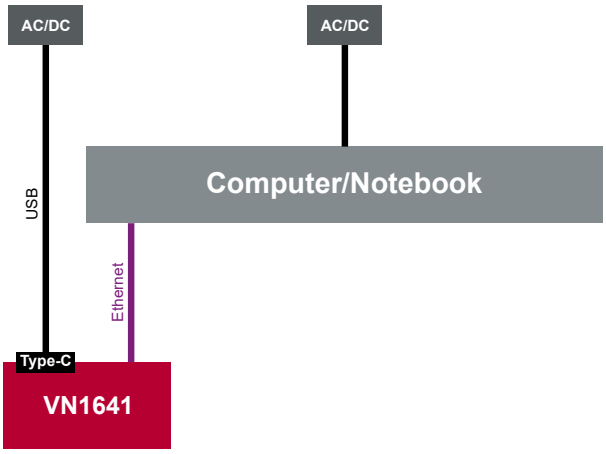


Figure 55: External power supply

Vehicle power

The following picture shows one way of powering the VN1641 for use in a vehicle.

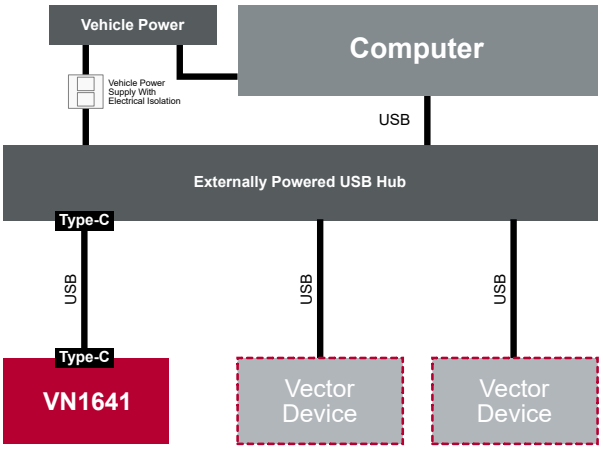


Figure 56: Vehicle power supply

Note

To avoid problems caused by ground offsets, the power supply to the hub must be **electrically isolated**. A Vector accessory for a electrically isolated vehicle power supply is planned; please contact Vector for availability.

2.7.6 LEDs

Description

The VN1641 has six LEDs indicating bus activities and status:

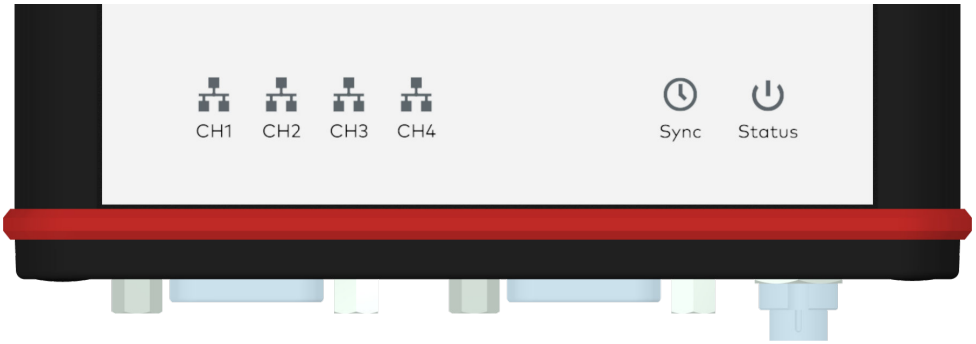


Figure 57: LEDs of the VN1641

- **CH1 … CH4 (with CANpiggies)**
  Multicolored channel LEDs, each indicating the bus activity for CAN.

Color	Description
Green	Data frames have been sent or received correctly.
Orange	CAN: Error frames have been sent or received.
Red	CAN: Bus off.

CAN: The flashing frequency depends on the bus load.

- **Sync**
  LED illuminates if the device is synchronized.

Color	Sync State	Description
Off	Not configured.	No master or slave protocols are active for this device or no configuration has been loaded yet.
Orange	Configured, waiting for master.	A slave protocol is active, but no master could be found / assigned yet. The state is assumed when the PTP protocol **Slave** or **Best-Master** is activated in the firmware, i. e. when starting the PTP stack in the firmware or if one of the slave protocols was activated in the driver, i. e. when or after the configuration was applied by the Vector Timesync Service (vTSS).
Green (flashing)	Pending.	A slave protocol is active and a master was found or could be assigned. The SYNC condition / the steady state was not yet reached or was left again. - **PTP** Transition to the Slave-With-Master state, but the SYNC condition has not yet been reached.

Color	Sync State	Description
		► **HW-SYNC** Pulse and master time present, but the SYNC accuracy has not yet been reached. ► **SW-SYNC** SYNC accuracy not yet reached.
Green	In-sync.	SYNC condition reached and is met or only master protocols active on the interface.
Red	Failure.	► **PTP** Master lost, SYNC accuracy not maintained. ► **HW-SYNC** Missing pulse, missing time information of the master, SYNC accuracy not maintained. ► **SW-SYNC** SYNC accuracy not maintained. If the SYNC accuracy is not maintained but the master is present, this state is only maintained for three seconds, then the state changes to **Pending**.

► **Status**

Multicolored LED indicating the device status.

Color	Description
Green	Flashes 4x at power up and illuminates afterwards. Flashes quicker during an update progress. Please wait for the automatic reboot of the device after the update has been finished. Afterwards the LED is permanent on.
Red	An error has occurred. Please disconnect the power supply as well as the USB or Ethernet cable. Re-connect the power supply and the USB/Ethernet cable and try again. Flashes when the max. temperature has been reached.

2.7.7 Bus Configuration

Piggybacks

The VN1641 has four piggyback plug-in locations (CH1…CH4). Depending on use cases, electrically decoupled CAN SIC XL, CAN SIC or CAN High-Speed transceivers can be used.

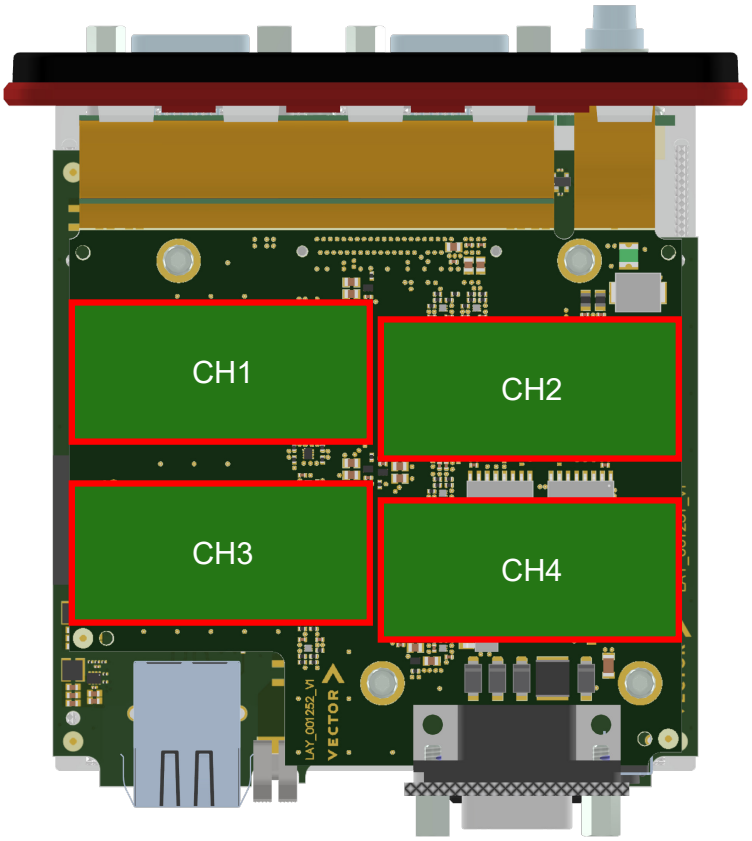


Figure 58: Piggyback plug-in locations for CH1…CH4

2.7.8 Pin Assignment CH1...CH4

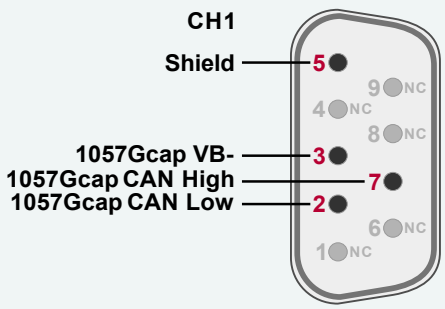
Assignment of the D-SUB9 connectors

The pin assignments depend on the inserted piggybacks. A list of compatible piggybacks can be found in the accessories manual or on our website.

Example

CANpiggy 1057Gcap

The following example shows the pin assignment of CH1 if a CANpiggy 1057Gcap is inserted in the plug-in location at channel 1:

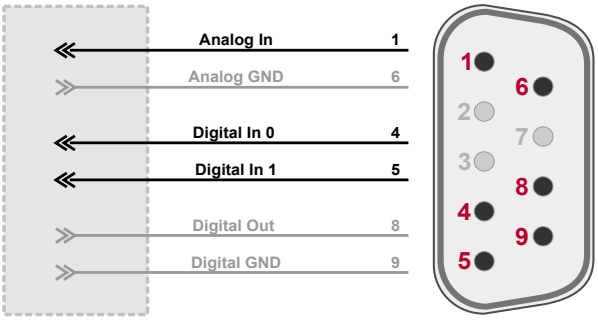


2.7.9 Pin Assignment CH5

Digital/analog IO

The pin assignment for CH5 is as follows:

Pin	Assignment
1	Analog input
2	Not connected
3	Not connected
4	Digital input 0
5	Digital input 1
6	Analog GND
7	Not connected
8	Digital output
9	Digital GND



Internal interconnection of digital input 0/1

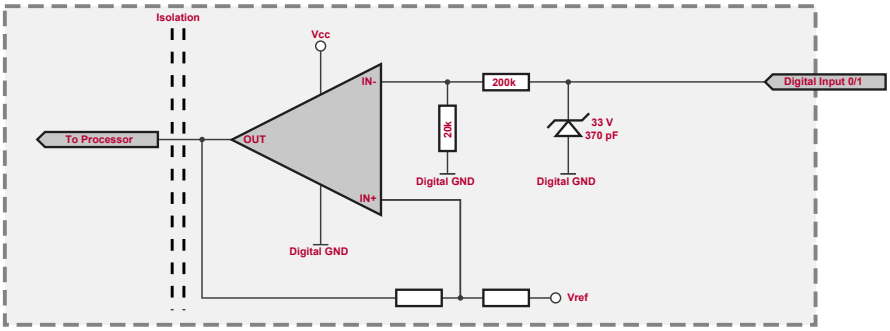


Figure 59: Digital input 0/1

Internal interconnection of digital output

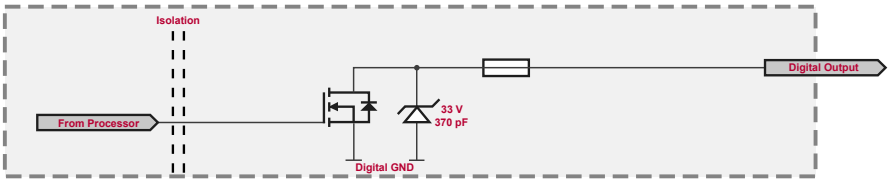


Figure 60: Digital output

Internal interconnection of analog input

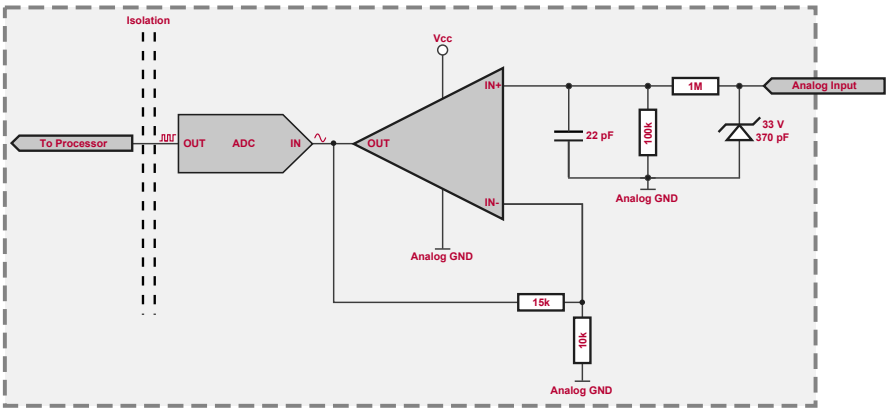


Figure 61: Analog input

Extended measuring range of the analog input

In normal operation, voltages up to 18 V can be applied and measured at the analog input. The cutoff frequency f_c (-3 dB) for AC voltages is approx. 7.2 kHz.

For measurements above 18 V (max. 50 V), an external series resistor has to be applied to the analog input. The series resistor R_{ext} depends on the input voltage U_{input} and can be calculated as follows:

$$R_{ext}\,[kOhm] = [(U_{input} * 0.61111) - 11] * 100$$
$$with\ 18\,V < U_{input} \leq 50\,V$$

The cutoff frequency for AC voltages is also affected by the external series resistor:

$$f_c\left[Hz\right] = \frac{1}{2.33 * 10^{-6} * R_{ext}\,[kOhm]}$$

Examples

	24 V	32 V	36 V	48 V
R_{ext}	367 kΩ	856 kΩ	1100 kΩ	1833 kΩ
R_{ext} (E96)	374 kΩ (24.12 V)	866 kΩ (32.17 V)	1100 kΩ (36.00 V)	1870 kΩ (48.60 V)
f_c (-3 dB)	1148 Hz	496 Hz	390 Hz	230 Hz

2.7.10 Replacing Piggybacks

Caution!
Ensure an ESD safe working environment during disassembly and assembly. Avoid touching the top, bottom or connectors of the boards during this process to avoid ESD damage.

Step by Step Procedure

1. First, loosen the VN1641 housing screws on the side with the four D-SUB9 connectors. This requires removing the two black decorative caps. Then carefully pull the PC-board out of the housing.

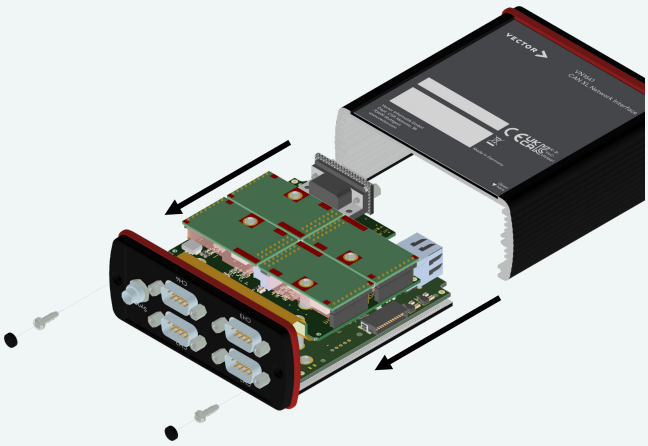


Figure 62: Opening the housing

2. The plug-in locations are defined as follows:

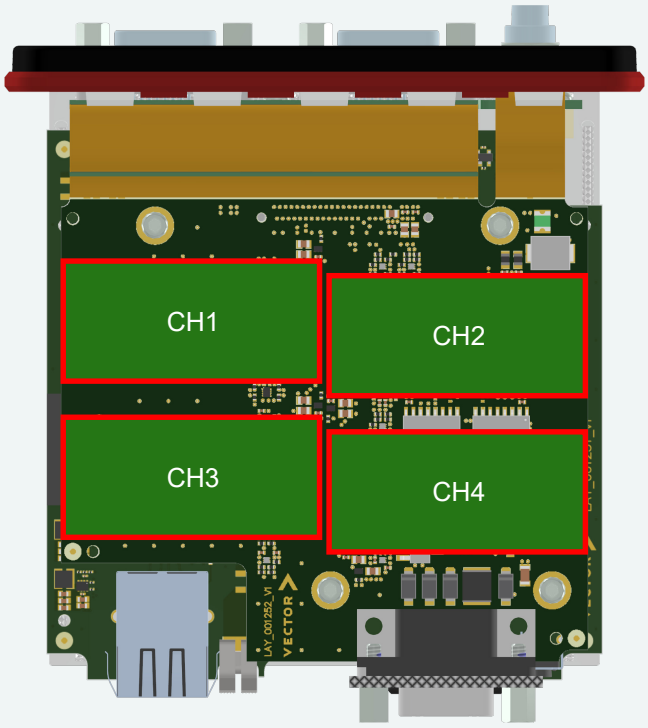


Figure 63: Piggyback plug-in locations CH1…CH4

3. Each piggyback is fastened by a screw and retainer. Please loosen the appropriate screw including the retainer and carefully remove the piggyback from the plug-in location.

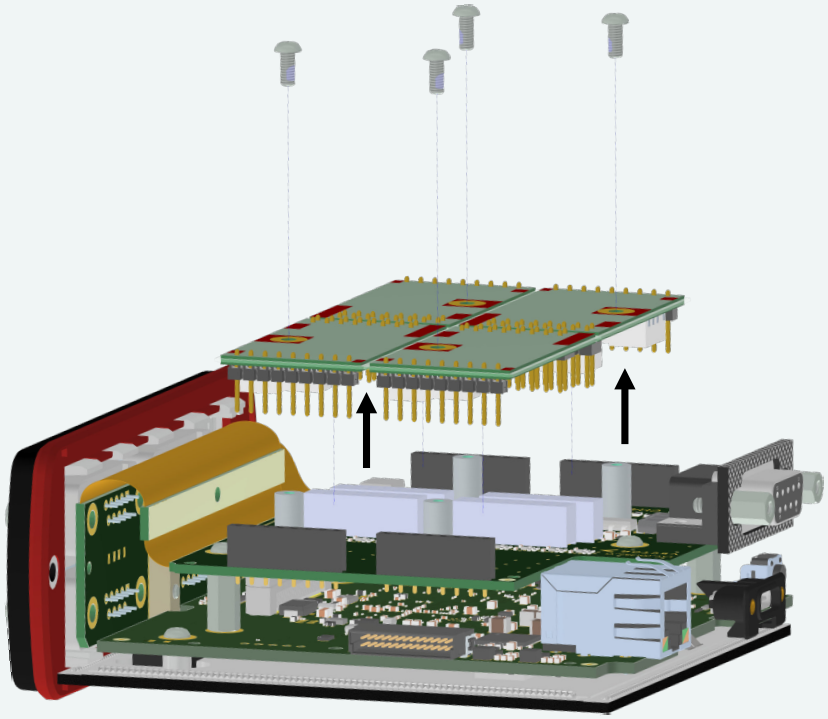


Figure 64: Unmount/mount piggybacks

4. Insert the replacement piggyback. When doing this please make sure that the single and dual-row connectors are not laterally offset.
5. Secure the new piggyback with the appropriate screw and retainer.

6. Place the VN1641 main board back in the housing. This operation involves placing the housing on a table with its back side (side with the bar code) facing upward. Then the main board with the piggybacks facing upward is inserted into the first guide rails.

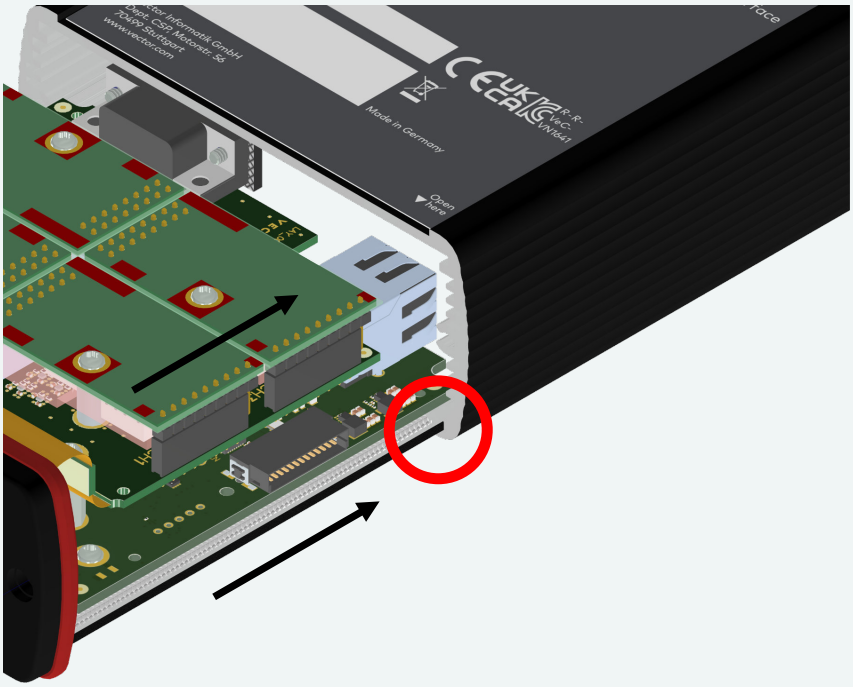


Figure 65: First guide rails

7. Slide the main board into the housing a few millimeters without forcing it. Close the housing by applying light pressure and then secure it with the appropriate screw fasteners. The screws should be secure but not excessively tight.
8. Please also attach the two black decorative caps.
9. Connect the VN1641 and the computer via the USB cable and check the bus configuration in the **Vector Hardware Manager** (page **Device Properties**, **Status** mode).

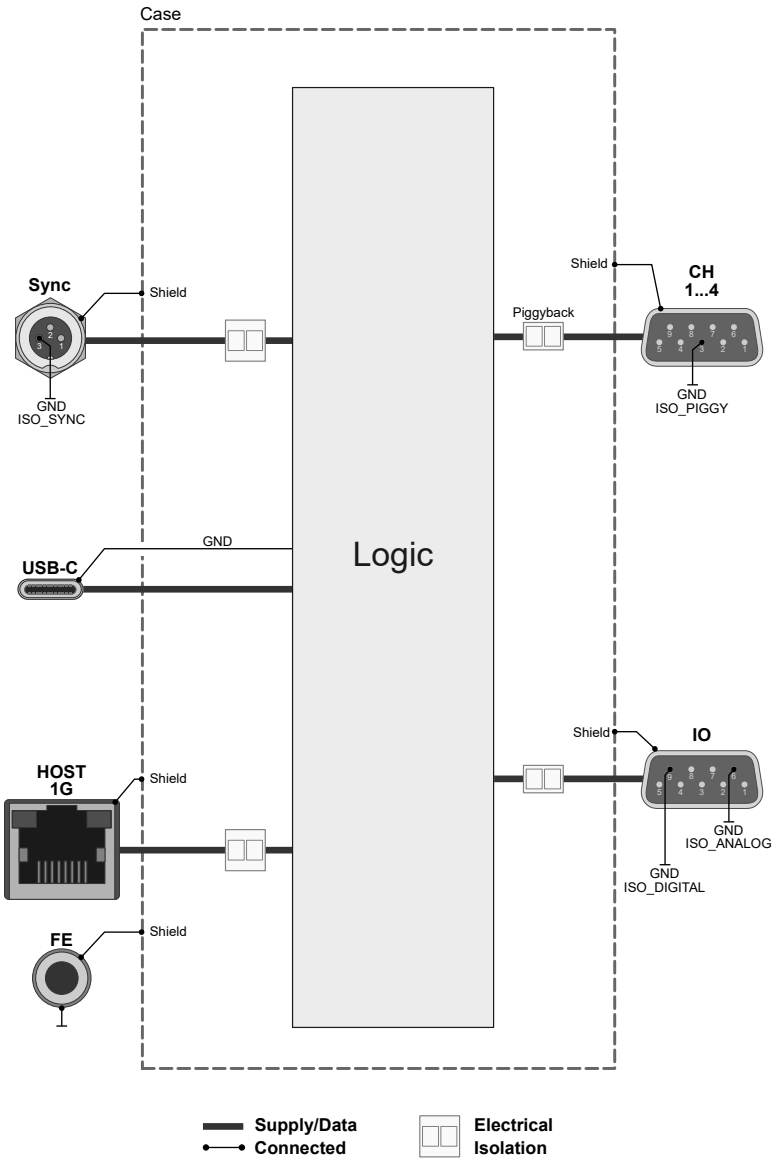
2.7.11 Technical Data

CAN channels	Max. 4 4x configurable via piggybacks Bitrates - CAN: up to 1 Mbit/s (up to 2 Mbit/s depending on wiring and transceivers) - CAN FD: up to 5 Mbit/s (up to 8 Mbit/s depending on wiring and transceivers) - CANXL: up to 16 Mbit/s (up to 20 Mbit/s depending on wiring and transceivers; for bitrates > 5 Mbit a CAN SIC XL transceiver is required)
Analog input	10 bit Input 0 V...18 V Voltage tolerance up to 50 V (with series resistor) Sampling rate up to 1 kHz
Digital input	Range 0 V...32 V Schmitt trigger high 2.7 V, low 2.2 V Hysteresis 0.5 V Input frequencies up to 1 kHz
Digital output	Open Drain External supply up to 32 V Current max. 500 mA Short circuit / over voltage protected
Time stamps	Accuracy (within one device): 1 µs Accuracy software sync: typ. 50 µs Accuracy hardware sync: typ. 1 µs Accuracy IEEE1588 – PTP: typ. 1 µs
Host computer connection	USB 3.2 Gen. 1 via USB Type-C Gigabit Ethernet 1000BASE-T
Power supply	USB connection: via USB Ethernet connection: external supply via USB Type-C
Power consumption	Max. 7.5 W
Temperature range	Operating: -40 °C...+55 °C Shipping and storage: -40 °C ... +85 °C
Relative humidity of ambient air	15 %...95 %, non-condensing
Dimensions (LxWxH)	Approx. 114 mm x 111 mm x 45 mm
Weight	450 g (without piggybacks)
Operating system requirements	Windows 11 (x64, 64 bit)

2.7.12 Electrical Isolation

2.7.12.1 Connectors

Electrical isolation of the connectors



Note

Please note that the shield of the USB-C connector has the same potential as the logic ground of the device and that this is isolated from the housing ground of the device. This is to avoid ground loops when used with a computer system without an electrically isolated power supply.

The FE socket of the device must be connected to the user-side system ground when the device is operated in the vehicle.

2.7.12.2 Piggybacks



Reference
For information on the electrical isolation of the piggybacks, please refer to the separate accessories manual.

2.7.13 Accessories



Reference
Information on available accessories can be found in the separate accessories manual on our website.

Bus transceiver	▶ CANpiggies
Cables and connectors	▶ CANcable0 ▶ CANcable1 ▶ CANcableA ▶ CANcable TnT ▶ CANcable Y ▶ CANterm 120 ▶ CANcable Set Pro ▶ Vector SYNCcableXL ▶ Vector SYNCcable50 ▶ Multi SYNCbox external ▶ Multi SYNCbox active ▶ Cable Binder 3pol Connector with Pigtail ▶ USB Cable 3.1 Type C-C (Dual Screw Lock) ▶ USB 3.2 Gen2x1 Hub
Power supply	▶ Power Supply USB-C Basic
Miscellaneous	▶ Fix Kit 42mm Device ▶ Protection Kit 1040

2.8 VN1670

2.8.1 Scope of Delivery

Contents

The delivery includes:

- VN1670 (incl. housing feets)
- USB Cable 3.1 Type A-C (Dual Screw Lock, part no. 05140)
- Vector Power Supply ODU MINI-SNAP (part no. 05068)

2.8.2 Main Features



Figure 66: VN1670

VN1670 features

The main features of the VN1670 interface are:

- Support of CAN XL, CAN FD, CAN 2.0 and LIN
- CAN XL
  - Support of CAN XL Error Signaling Enabled and Error Signaling Disabled
  - Supported on the piggyback channels
- CAN /CAN FD: Support of a Transport Protocol (TP) acceleration
- Max. 15 channels:
  - 5x on-board CAN/CAN FD channel (electrically decoupled)
  - 5x on-board LIN channel (electrically decoupled)
  - 5x additional plug-in location for CAN-/LINpiggies
- Digital and analog inputs/outputs via the new VNpiggy30 IO 8644[1]
- Synchronization of multiple devices and other bus systems like CAN XL, CAN FD, CAN, LIN, FlexRay, MOST, Ethernet
  - Software time synchronization (with USB host connection)

  - Hardware time synchronization
  - IEEE1588 – PTP (with Ethernet host connection)
- Possibilities for stacking and mounting the devices
- Computer connection via
  - USB 3.1 Gen. 1 via USB Type C connector with screw lock
  - Gigabit Ethernet 1000BASE-T
- Standby mode for power saving (configurable via Vector Hardware Manager)
- Configurable temperature limit to avoid device overheating (configurable via Vector Hardware Manager)
- Transparent integration into the Vector tools (CANoe/CANalyzer, CANape, vFlash, ...)
- Licensor: provides Vector licenses (USB host connection only)
- Multi-application support for CAN XL/CAN FD/CAN channels: different tools can use one channel at the same time
- Usage in car (passenger and luggage compartment)
- Operating temperature range: -40 °C...+65 °C
- Kensington Lock: possibility to secure the VN1670 with a Kensington NanoSaver®
- Functional Earth for optional connection of housing ground to system ground

1) The VNpiggy30 IO 8644 is supported from driver version 24.40 (planned release 11/2024) and by CANoe 19 (planned release 03/2025) and higher.

2.8.3 Connectors Front Side

Device connectors

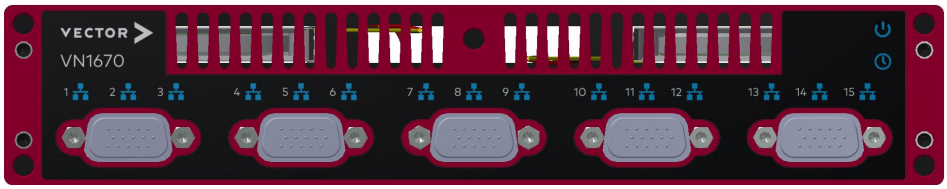
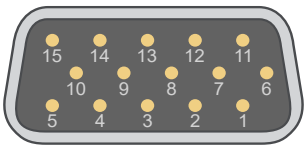


Figure 67: VN1670 connectors on front side

- **CH1...CH15 (5x D-SUB15HD male)**
  The VN1670 has five D-SUB15HD connectors. Each connector provides three channels:
  - 1x on-board CAN/CAN FD channel
  - 1x on-board LIN channel
  - 1x optional channel via a CAN, LIN piggyback.

D-SUB15HD	Channel	Channel Type
1	1	On-board CAN
	2	On-board LIN
	3	Optional piggyback
2	4	On-board CAN
	5	On-board LIN
	6	Optional piggyback
3	7	On-board CAN
	8	On-board LIN
	9	Optional piggyback
4	10	On-board CAN
	11	On-board LIN
	12	Optional piggyback
5	13	On-board CAN
	14	On-board LIN
	15	Optional piggyback

Pin assignment



VN1670			VNcable 3Y	
Channel	**Assignment**	**D-SUB15HD**	**D-SUB9**	**Channel**
CAN	CAN Low	14	2	A
	GND	10	3	
	CAN High	15	7	
	N.C.	5	9	
LIN	Pdis	3	2	B
	GND	9	3	
	LIN	4	7	
	Vbatt	13	9	
Piggy	N.C.	2	1	C
	CAN Low/Pdis*	1	2	
	GND	7	3	
	N.C.	11	4	
	CAN High/LIN*	6	7	
	N.C.	12	8	
	Vbatt*	8	9	

* via CAN- or LINpiggy

Note
Please use the VNcable3Y to split a D-SUB15HD connector into three separate D-SUB9 connectors (CAN: channel A, LIN: channel B and inserted piggyback at channel C). For more information, please refer to the accessories manual.

Note
For in-car-usage, ensure that the cables used for the CAN/LIN network access are appropriately fixed (not fixed by the VN1670 D-SUB connectors only).

2.8.4 Connectors Back Side

Device connectors

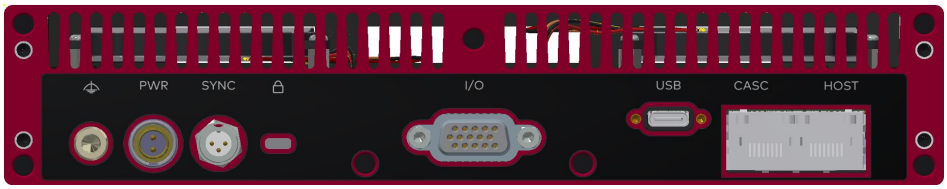
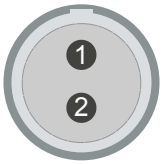


Figure 68: VN1670 connectors on back side

- **Functional Earth (FE)**
  Optional connection of housing ground to system ground.

- **Power (ODU)**
  For power supply, the VN1670 has a two-pin ODU connector (MINI-SNAP size 1, type GF1L0C-P02RP00-0000). Attach the enclosed power cable to power up the unit (matching ODU connector type S11L0C-P02NPL0-6200)

Pin	Assignment
1	Power supply (8 V ... 32 V)
2	Ground



- **Sync (Binder)**
  The VN1670 has a sync connector (Binder type 711) which can be used for time synchronization of different Vector devices (see section Time Synchronization on page 125).

Pin	Assignment
1	Terminal 15
2	Synchronization line
3	Ground



- **Kensington Lock**
  Mounting of Nano Kensington (NanoSaver).

- **IO (D-SUB15HD female)**
  The VN1670 has a D-SUB15HD connector for the digital and analog input/output signals of the VNpiggy30 IO 8644. The pin assignment is as follows:

Pin	Assignment
1	Digital input/output 6
2	Digital input/output 4
3	Digital input/output 2
4	Analog GND
5	Analog input/output 1
6	Digital input/output 7
7	Digital input/output 5
8	Digital input/output 3
9	Digital GND
10	Analog input/output 2
11	Digital PWM
12	Digital input/output 0
13	Digital input/output 1
14	Analog input/output 3
15	Analog input/output 0

- **USB (Type-C)**
  Connect your computer and the VN1670 via USB to install and to use the device with applications (e. g. CANoe, CANalyzer).

- **HOST (RJ45 connector)**
  Connect your computer and the VN1670 via 100BASE-TX or 1000BASE-T to use the device with applications (e. g. CANoe, CANalyzer).

- **CASC (RJ45 connector)**
  Reserved. Do not use.

2.8.5 LEDs

LEDs

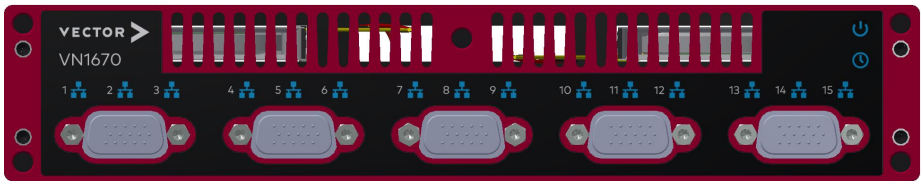


Figure 69: LEDs on front side

- **(CAN/LIN 1...15)**

Multicolored channel LEDs, each indicating the bus activity for CAN or LIN.

Color	Description
Green	Data frames have been sent or received correctly. The flashing frequency varies according to the message rate.
Orange	CAN: Error frames have been sent or received. LIN: Both valid and erroneous data were detected. The flashing frequency varies according to the message rate.
Red	CAN: Bus off. LIN: Only erroneous data was detected.

- **Sync**

LED illuminates if the device is synchronized.

Color	Sync State	Description
Off	Not configured.	No master or slave protocols are active for this device or no configuration has been loaded yet.
Orange	Configured, waiting for master.	A slave protocol is active, but no master could be found / assigned yet. The state is assumed when the PTP protocol **Slave** or **Best-Master** is activated in the firmware, i. e. when starting the PTP stack in the firmware or if one of the slave protocols was activated in the driver, i. e. when or after the configuration was applied by the Vector Timesync Service (vTSS).
Green (flashing)	Pending.	A slave protocol is active and a master was found or could be assigned. The SYNC condition / the steady state was not yet reached or was left again. ▶ **PTP** Transition to the Slave-With-Master state, but the SYNC condition has not yet been reached. ▶ **HW-SYNC** Pulse and master time present, but the SYNC accuracy has not yet been reached. ▶ **SW-SYNC** SYNC accuracy not yet reached.

Color	Sync State	Description
Green	In-sync.	SYNC condition reached and is met or only master protocols active on the interface.
Red	Failure.	► **PTP** Master lost, SYNC accuracy not maintained. ► **HW-SYNC** Missing pulse, missing time information of the master, SYNC accuracy not maintained. ► **SW-SYNC** SYNC accuracy not maintained. If the SYNC accuracy is not maintained but the master is present, this state is only maintained for three seconds, then the state changes to **Pending**.

► **Status**

Multicolored LED indicating the device status.

Color	Description
Green	Flashes 4x at power up and illuminates afterwards. Flashes quicker during an update progress. Please wait for the automatic reboot of the device after the update has been finished. Afterwards the LED is permanent on.
Red	An error has occurred. Please disconnect the power supply as well as the USB or Ethernet cable. Re-connect the power supply and the USB/Ethernet cable and try again. Flashes when the max. temperature has been reached.

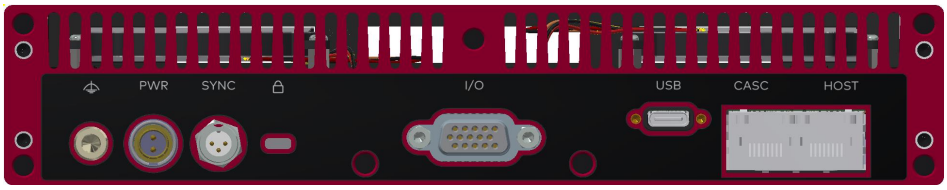


Figure 70: LEDs on back side

- **Ethernet HOST**

  Multicolored LED indicating the Ethernet status.

Activity (left LED)	Description
Green	Activity.
Off	No activity.

Speed (right LED)	Description
Green	1000 Mbit/s
Orange	100 Mbit/s
Off	10 Mbit/s

2.8.6 Bus Configuration

Piggybacks

The VN1670 has five piggyback plug-in locations (CH3, CH6, CH9, CH12, CH15). Depending on use cases, electrically decoupled CAN SIC XL, CAN SIC, CAN High-Speed, CAN Low-Speed or LIN transceivers can be used.

Note
A list of compatible piggybacks can be found in the accessories manual or on our website.

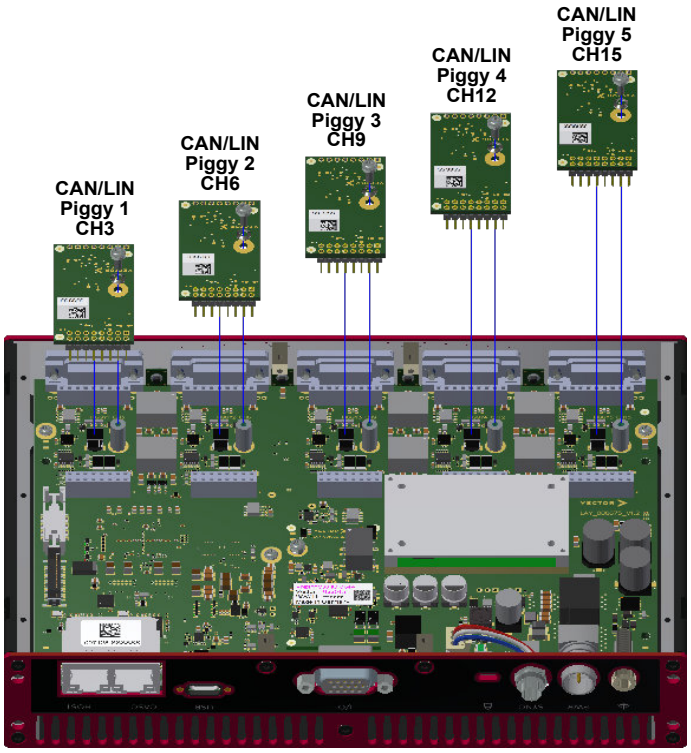


Figure 71: Piggyback plug-in locations

Configurations					
Channels	**Piggy 1**	**Piggy 2**	**Piggy 3**	**Piggy 4**	**Piggy 5**
10x CAN + 5x LIN	CAN1	CAN2	CAN3	CAN4	CAN5
9x CAN + 6x LIN	CAN1	CAN2	CAN3	CAN4	LIN1
8x CAN + 7x LIN	CAN1	CAN2	CAN3	LIN2	LIN1
7x CAN + 8x LIN	CAN1	CAN2	LIN3	LIN2	LIN1
6x CAN + 9x LIN	CAN1	LIN4	LIN3	LIN2	LIN1
5x CAN + 10x LIN	LIN5	LIN4	LIN3	LIN2	LIN1

Insertion order:
CANpiggies starting with CH3 (Piggy 1) up to CH15 (Piggy 5).
LINpiggies starting with CH15 (Piggy 5) down to CH3 (Piggy 1).
Empty piggyback sockets between CAN and LIN are accepted.

Note
Please use the VNcable3Y to split a D-SUB15HD connector into three separate D-SUB9 connectors (CAN: channel A, LIN: channel B and inserted piggyback at channel C). For more information, please refer to the accessories manual.

Note
CAN XL Configuration

The piggyback channels of the VN1670 support the CAN XL modes Error Signaling Enabled and Error Signaling Disabled:

- **CAN XL mode Error Signaling Enabled**
  This operating mode is intended for bitrates up to 5 Mbit/s. To use this mode, a CAN High-Speed, a CAN SIC or a CAN SIC XL piggyback can be used.
- **CAN XL mode Error Signaling Disabled**
  This operating mode is intended for bitrates above 5 Mbit/s. This requires a CAN SIC XL piggyback, which must be configured for transceiver Fast Mode.

The configuration of the CAN XL operating mode and the Fast Mode of the CAN SIC XL piggyback must be done in the application (e. g. CANoe, CANalyzer, CANape).

Please contact Vector for information on the planned availability of the CAN SIC XL piggyback.

Caution!
Operating a CAN SIC XL piggyback in Fast Mode

When using a CAN SIC XL piggyback in Fast Mode, the VN1670 is fully compliant with the corresponding EMC regulations starting with **hardware revision 3**.

Previous hardware revisions are not fully compliant to EMC regulations regarding radition and therefore do not support an operation in Fast Mode.

Please contact Vector for further options if you have a VN1670 with hardware revision < 3 and intend to use a CAN SIC XL piggyback in Fast Mode.

2.8.7 Replacing Piggybacks

Caution!
Ensure an ESD safe working environment during disassembly and assembly. Avoid touching the top, bottom or connectors of the boards during this process to avoid ESD damage.

Step by Step Procedure

1. First, loosen the VN1670 housing screws on the bottom. Then carefully remove the cover.

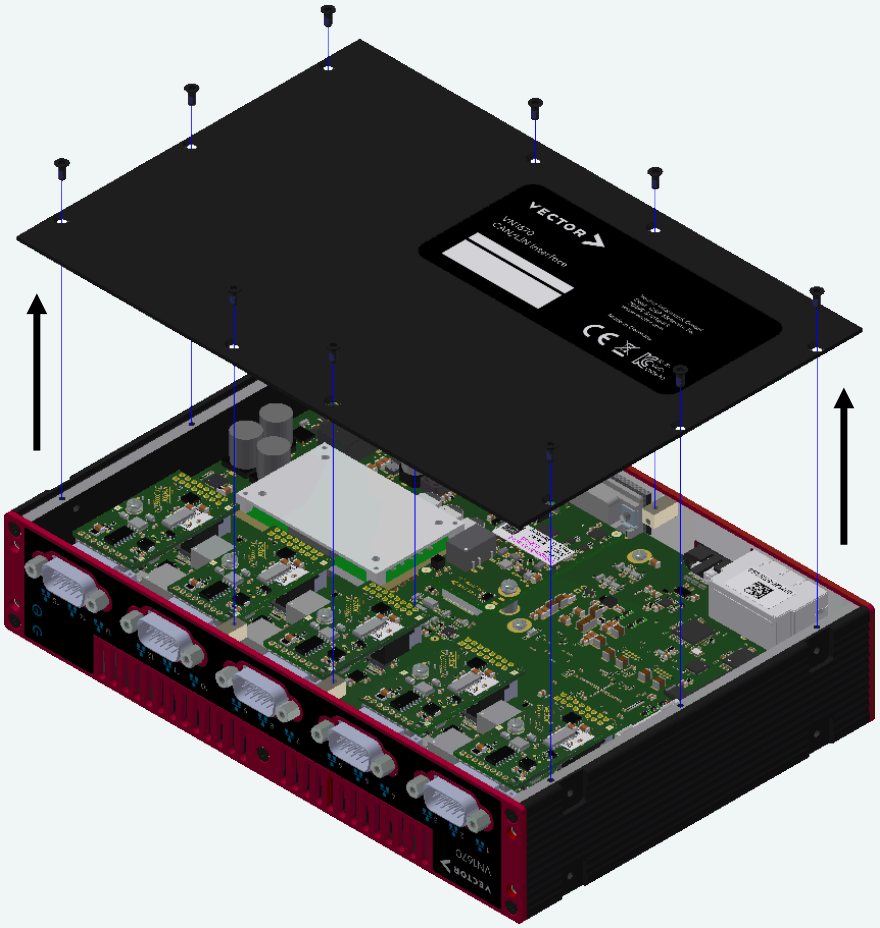


Figure 72: Opening the housing

2. The plug-in locations are defined as follows:

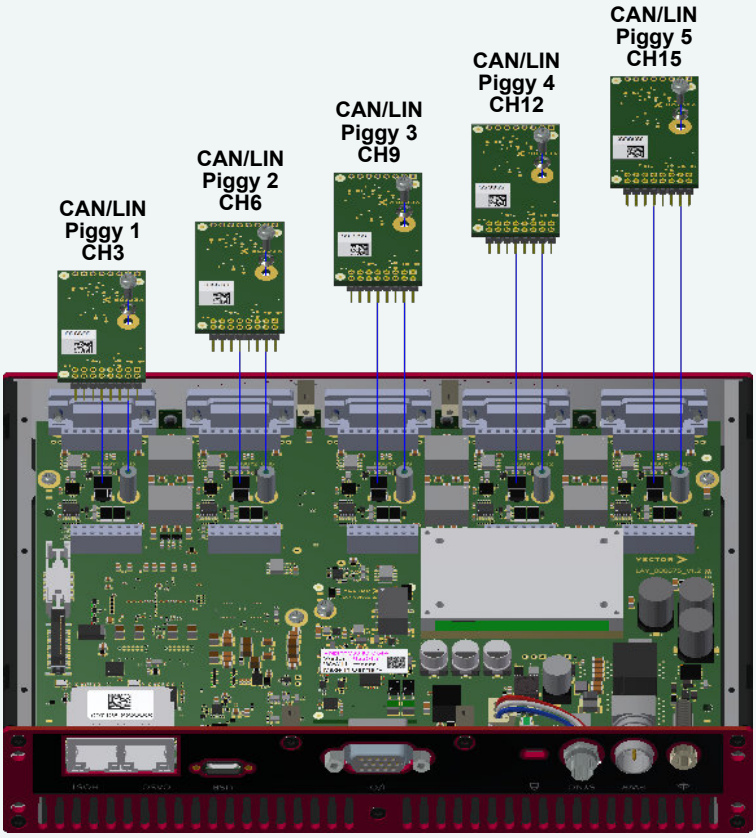


Figure 73: CAN/LIN piggyback plug-in locations

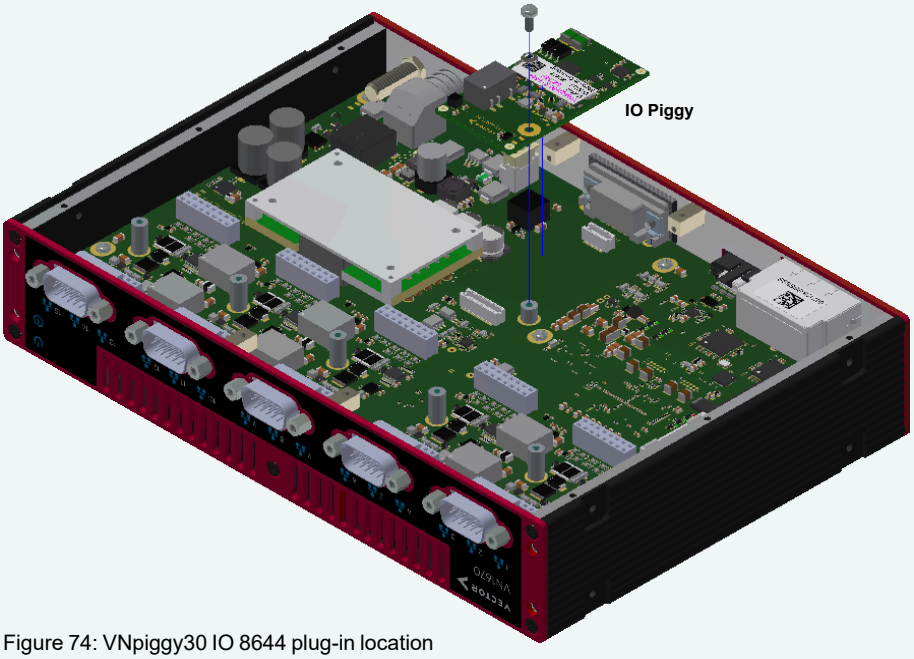


Figure 74: VNpiggy30 IO 8644 plug-in location

3. Each piggyback is fastened by a screw and retainer. Please loosen the appropriate screw including the retainer and carefully remove the piggyback from the plug-in location.

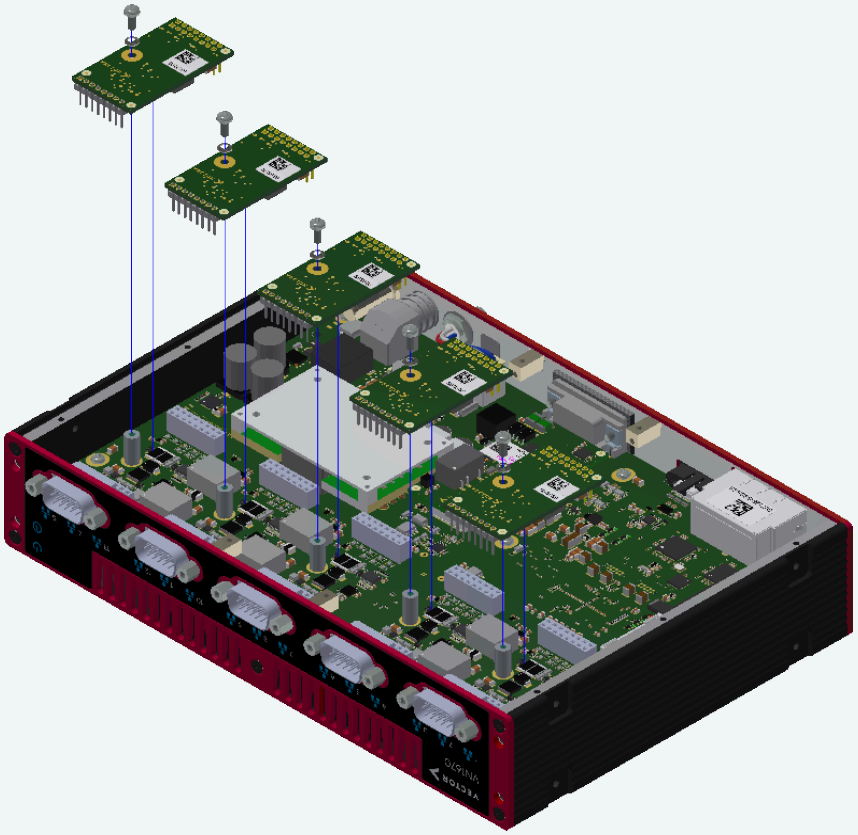


Figure 75: Unmount/mount piggybacks

4. Insert the replacement piggyback. When doing this please make sure that the single and dual-row connectors are not laterally offset.
5. Secure the new piggyback with the appropriate screw and retainer.
6. Reattach the bottom cover and then secure it with the appropriate screw fasteners. The screws should be secure but not excessively tight.
7. Power the VN1670, connect the device with the host and check the bus configuration in the **Vector Hardware Manager** (page **Device Properties**, **Status** mode).

2.8.8 Standby Operation

Activating the standby feature

The device supports a standby mode which can be activated via the Vector Hardware Manager | Device Properties Configuration.

The standby feature can be used by monitoring one of the following standby sources:

- the USB (Type A) host interface (via USB Type A-C cable only),
- the Ethernet host interface or
- the corresponding IO pin (terminal 15, pin 1 on the **Sync** connector).

Pin	Assignment
1	Terminal 15
2	Synchronization line
3	Ground



If the USB or Ethernet connection is interrupted (e. g. cable disconnected) or terminal 15 is set (0 V), the interface is set to standby after a certain time. The timeout can be set in Vector Hardware Manager | Device Properties Configuration.

If the USB or Ethernet connection is active again or terminal 15 is reset (rising edge to 12 V), the interface wakes up again.

Reference
Please find the power consumption values in section Technical Data on page 106.

Note
Some Ethernet network adapters (e. g. Intel I219-LM) support an Ultra Low Power Mode (please check the power management settings of the Ethernet network adapter of your host computer).

If the Ultra Low Power Mode is enabled, the VN1670 will not wake up from standby. Therefore, the Ultra Low Power Mode of the host computer's Ethernet port must be disabled if Ethernet is configured as the standby source for VN1670.

2.8.9 Device Stacking

Due to the design of the system housing, this Vector device can be directly stacked or mounted side by side. This is supported by the side recesses on the housing.



Figure 76: Stacked mounting (example with VN5650)

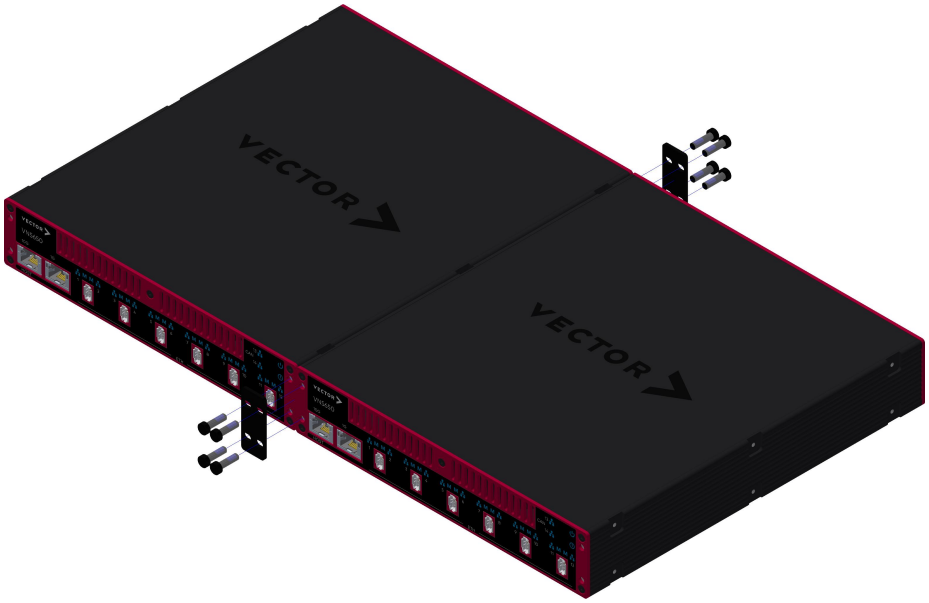


Figure 77: Side-by-side mounting (example with VN5650)

To further increase the mechanical stability of stacked devices, the mounted feet can be removed and replaced by the VSH Connecting Kit Vertical (see accessories manual, part number 05152).

2.8.10 Technical Data

CAN channels	Max. 10 5x on-board CAN/CAN FD - hardware revision 2 or lower: NXP TJA1057GT hardware revision 3 or higher: NXP TJA1057BT - electrically decoupled 5x configurable via piggybacks Bitrates - CAN: up to 1 Mbit/s (up to 2 Mbit/s depending on wiring and transceivers) - CAN FD: up to 5 Mbit/s (up to 8 Mbit/s depending on wiring and transceivers) - CANXL: up to 16 Mbit/s (up to 20 Mbit/s depending on wiring and transceivers; for bitrates > 5 Mbit a CAN SIC XL transceiver is required)
LIN channels	Max. 10 5x on-board LIN - Infineon TLE7259-3 - electrically decoupled 5x configurable via piggybacks Bitrates - Normal-Mode: up to 20 kBit/s - Flash-Mode: up to 115.2 kBit/s (depending on wiring higher bitrates are possible)
Digital/analog input/output	Via VNpiggy30 IO 8644 (optional)
Time stamps	Accuracy (within one device): 1 µs Accuracy software sync: typ. 50 µs Accuracy hardware sync: typ. 1 µs Accuracy IEEE1588 – PTP: typ. 1 µs
Host computer connection	USB 3.1 Gen. 1 via USB Type-C Gigabit Ethernet 1000BASE-T
Power supply	External 8 V...32 V (typ. 12 V)
Power consumption	Typ. 10 W[1)] Max. 16 W[2)] Standby: 35 mW
Temperature range	Operation: -40 °C ... +65 °C Storage: -40 °C ... +85 °C
Relative humidity of ambient air	15 %...95 %, non-condensing
Dimensions (LxWxH)	159 mm x 216 mm x 42 mm (height without housing feet)
Weight	1.4 kg
Operating system requirements	Windows 10 (x64, 64 bit) Windows 11 (x64, 64 bit)
Required CANoe version	CANoe 15 SP3 or higher

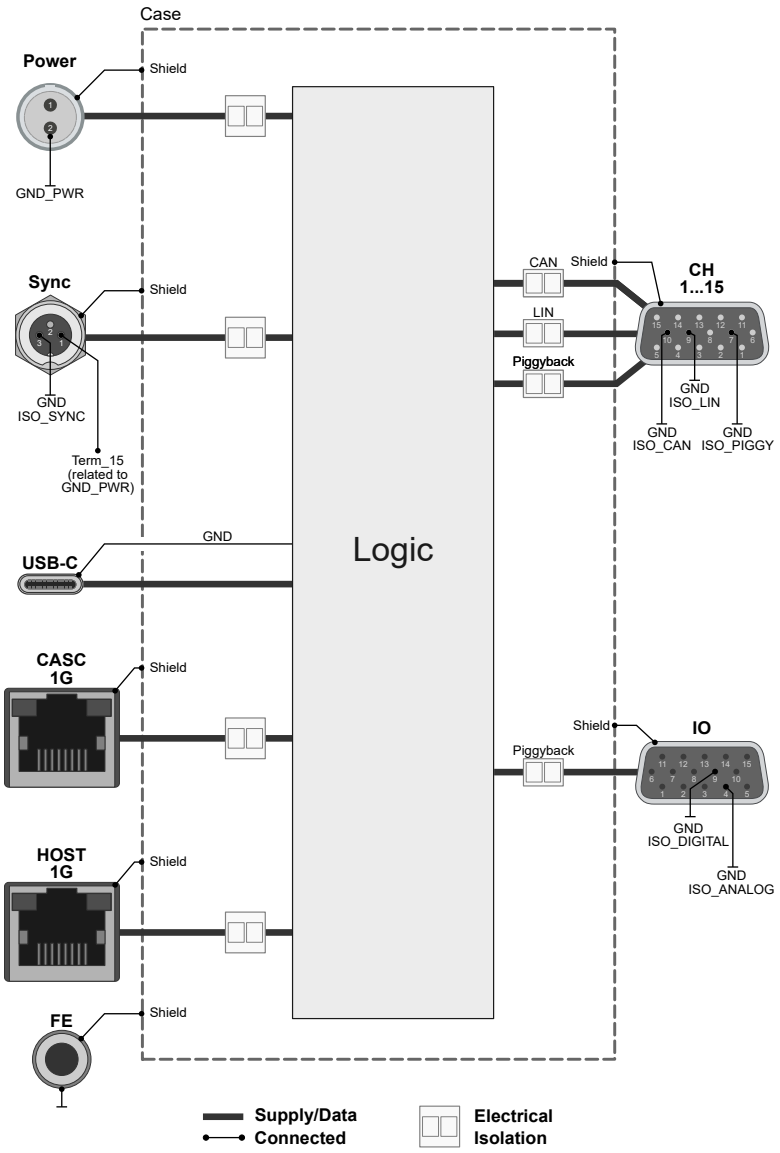
	CANoe 17 or higher for CAN XL

1) Setup: 10x CAN (1 Mbit, 100 % busload), 1x LIN, USB host connection, 25 °C ambient temperature,12 V external supply.
2) Setup: 10x CAN (1 Mbit, 100 % busload), 5x LIN, Ethernet host connection, VNpiggy30 IO 8644 at full load, cascading port at high load, +65 °C ambient temperature.

2.8.11 Electrical Isolation

2.8.11.1 Connectors

Electrical isolation of the connectors



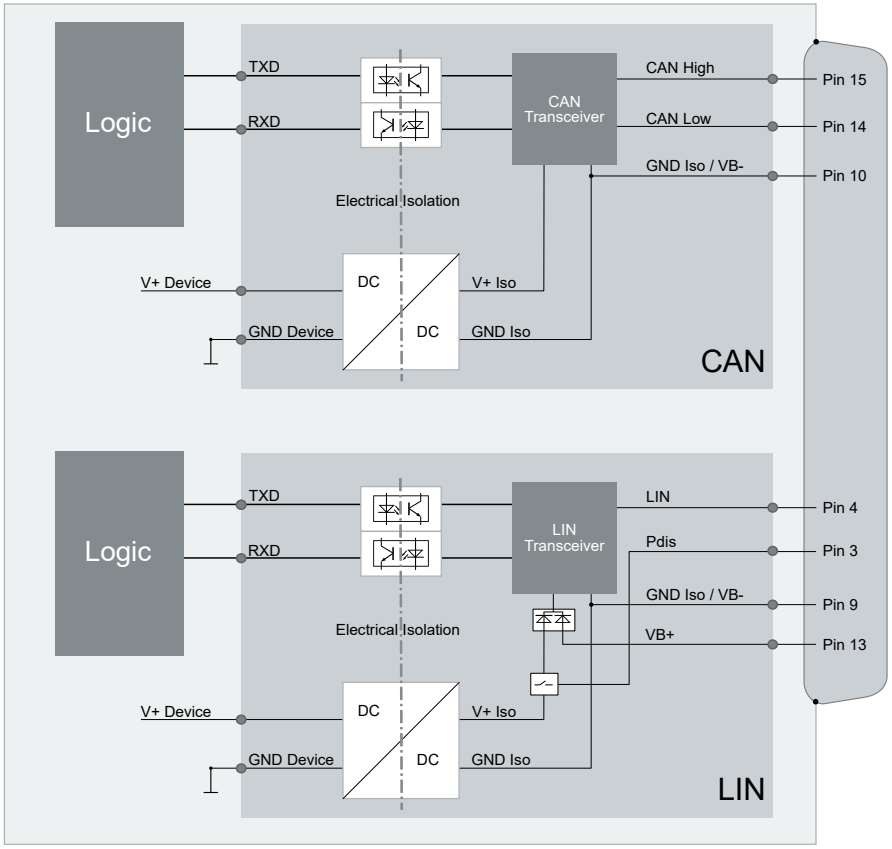
Note

Please note that the shield of the USB-C connector has the same potential as the logic ground of the device and that this is isolated from the housing ground of the device. This is to avoid ground loops when used with a computer system without an electrically isolated power supply.

The FE socket of the device must be connected to the user-side system ground when the device is operated in the vehicle.

2.8.11.2 On-board Channels

Electrical isolation of the on-board channels



2.8.11.3 Piggybacks

Reference
For information on the electrical isolation of the piggybacks, please refer to the separate accessories manual.

2.8.12 Accessories



Reference
Information on available accessories can be found in the separate accessories manual on our website.

Bus transceiver	▶ CAN-/LINpiggies
Cables and connectors	▶ VNcable 3Y ▶ CANterm 120 ▶ Vector SYNCcableXL ▶ Vector SYNCcable50 ▶ Multi SYNCbox external ▶ Multi SYNCbox active ▶ Cable Binder 3pol Connector with Pigtail ▶ USB Cable 3.1 Type C-C (Dual Screw Lock) ▶ Ethernet cables
Power supply	▶ Vector Power Supply ODU Mini-Snap ▶ Cable Vehicle Input <> ODU Mini-Snap ▶ Cable Banana Plug <> ODU Mini-Snap
Miscellaneous	▶ VSH Connecting Kit 19" ▶ VSH Connecting Kit Horizontal ▶ VSH Connecting Kit Vertical ▶ VSH Equipment Foot Kit ▶ VSH Mounting Flange

3 Getting Started

In this chapter you find the following information:

3.1 Driver Installation 112
3.1.1 General Information 112
3.1.2 Installation Instructions 112
3.1.3 Command Line 114
3.2 Vector Hardware Manager 120
3.2.1 Hardware Configuration 120
3.2.2 Tool Location and Help 120
3.2.3 For VN1630 log Users 121
3.3 Loop Tests 122
3.3.1 CAN 123

3.1 Driver Installation

3.1.1 General Information

The Vector Driver Setup allows the installation or the removal of Vector devices.

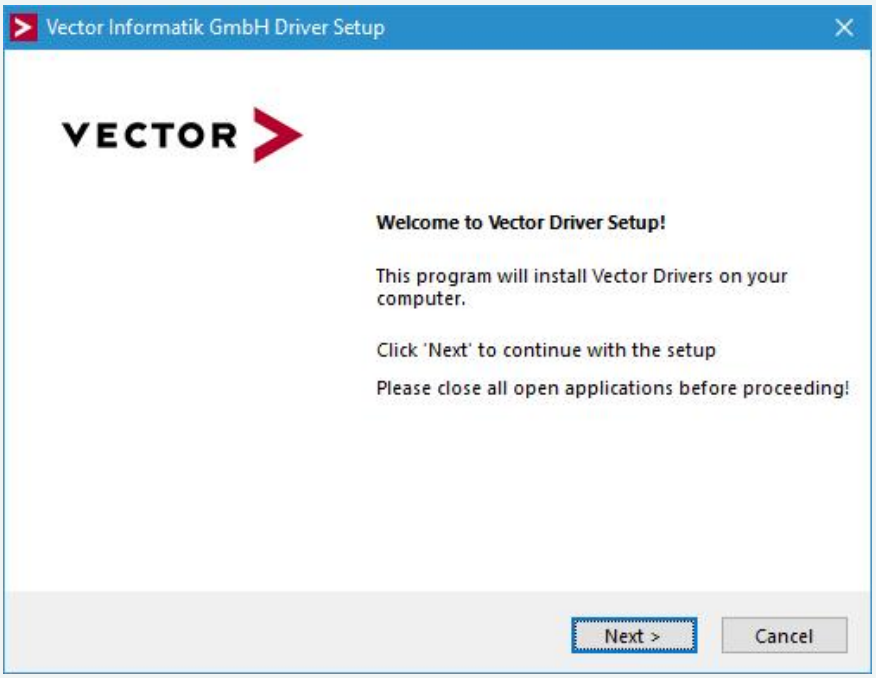
Note
Please note that you will need **Administrator Rights** for the following steps.

3.1.2 Installation Instructions

Step by Step Procedure

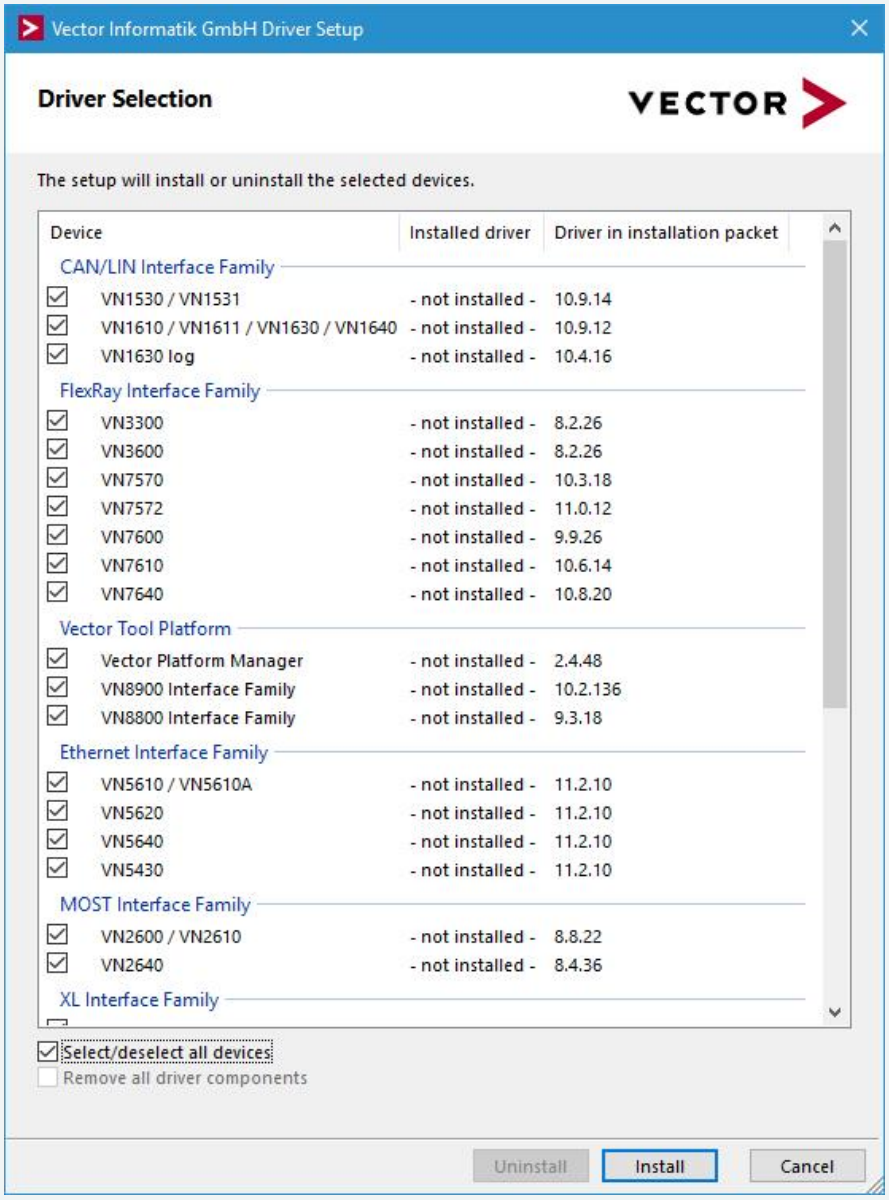
1. Execute the driver setup `\Drivers\Setup.exe` before the device is connected to the PC with the included USB cable.

   If you have already connected the device to the PC, the **Windows found new Hardware** wizard appears. Close this wizard and then execute the driver setup.



2. Click **[Next]** in the driver setup dialog. The initialization process starts.

3. In the driver selection dialog, select your devices to be installed (or to be uninstalled).



4. Click **[Install]** to execute the driver installation, or **[Uninstall]** to remove existing drivers.
5. A confirmation dialog appears. Click **[Close]** to exit. After successful installation, the device is ready for operation and can be connected to the PC with the included USB cable.

Reference

If you want to connect your computer and the device via Ethernet instead of USB, the device must be configured via the Vector Hardware Manager. A detailed description can be found in section **Tips and Tutorials** of the Vector Hardware Manager help.

3.1.3 Command Line

Command line installation is an important feature for administration purposes when new drivers need to be installed or updated in the background without user interaction.

This section describes how to use the command line for

- Vector drivers
- Vector Platform Manager

3.1.3.1 Vector Driver

Prerequisites

Prerequisites

Administrative rights are required to use the `setup.exe` command line tool. If the device is not connected to the computer during installation, a pre-installation to the Windows Driver Store is performed. If the device is connected to the computer for the first time, the device driver installation must be completed. The requirements and actual behavior of this process varies between Windows operating systems (see section Remarks on page 119).

Options and Actions

The `setup.exe` can be found on the Vector Driver Disk and provides a command line interface as follows:

```
setup.exe [option] [action]
```

Options

Option	Command	Description
Silent mode	`/s`	Executes the driver setup in silent mode. No user interaction is required. This command cannot be used with uncertified Vector drivers. Use with the `/installCert` option under Windows 7/8 and above.
No virtual driver	`/nv`	Does not install any virtual driver (Virtual CAN Bus).
Update only	`/uo`	The setup is forced to install only a newer version of a driver located in the folder `\Drivers`.
Vector DLLs only	`/dongleDLLsOnly`	Use this option to install only the Vector Keyman API DLLs. The WIBU service of the dongle manufacturer will not be installed. Attention: This option is only valid if you actually install the Vector Keyman driver. This means using action: `/i keyman`.
Install certificate	`/installCert`	This option installs the Vector driver certificate in the local certificate store under trusted publishers. Use this option in conjunction with the `/s` option to silently install the Vector drivers under Windows 7/8 and above.
No CodeMeter runtime service	`/ncmr`	Does not install the WIBU service.

Actions

Action	Command	Description
Install	`/i <driver name>`	Installs the specified driver from the driver source path.The driver name is the name of the device (e. g. `vn1630`). Lower case and upper case will be ignored.
Install all	`/i all`	Installs all available interface drivers from the driver source path. Note: The following drivers are **not auto-**

Action	Command	Description
		matically installed with the `all` option: Vector Keyman VN8900 Ethernet driver (vnIpClient). They must be installed explicitely.
Install all and Vector Keyman	`/i all keyman`	Installs all available interface drivers from the driver source path and the Vector Keyman.
Install all and Vector Keyman	`/i all keyman`	Installs all available interface drivers from the driver source path and the Vector Keyman.
Uninstall	`/u <driver name>`	Removes (uninstalls) the specified driver from the system. The driver name is the name of the device (e. g. `vn1630`). Lower case and upper case will be ignored.
Uninstall all	`/u all`	Removes (uninstalls) all interface drivers and driver components from the system. This action removes everything except for the Vector Keyman and the VN8900 Ethernet driver (vnIpClient).
Uninstall all and Vector Keyman	`/u all keyman`	Removes (uninstalls) all available interface drivers from the system including the Vector Keyman.
Info	`/info <file name>`	Creates a new file containing information about the drivers, which are available in this installation package (e. g. the version number).
Install Vector Keyman	`/i keyman`	Installs only the Vector Keyman.
Install virtual driver and driver components only	`/i virtual`	Installs the virtual driver and the driver components only.
Uninstall Vector Keyman	`/u keyman`	Uninstalls the Vector Keyman.
Uninstall the virtual driver and driver components	`/u virtual`	Uninstalls the virtual driver and the driver components only.
No automatic update	`/noAutoUpdate <driver name>`	Disables automatic updating of software running on the device when a driver is installed on the host system. The driver name is the name of the device (e. g. vx1161.41). Lower case and upper case will be ignored. If the specified driver does not support this feature, the action is silently ignored.
No automatic update all	`/noAutoUpdate all`	Disables automatic updating of software running on the device when a driver is installed on the host system for all drivers that support this feature.

Return Values

When executing `setup.exe` in command line mode, the following values may be returned:

Return Value	Description
0	The operation was successful.
1	The installation was not successful.
2	The uninstallation was not successful.
3	Restart of the system is required.
4	Command `/info` could not be executed.

Examples

Action	Command
`setup.exe /s /installCert /i all`	Installs all interface drivers silently. Except for the Vector USB dongle, the Vector Keyman and the VN8900/VN8810 Ethernet drivers.
`setup.exe /s /installCert /i all vnipclient vnipcl8800`	Installs all interface drivers silently including the VN8900/VN8810 Ethernet drivers.
`setup.exe /s /installCert /i all keyman`	Installs all interface drivers silently including the Vector Keyman.
`setup.exe /s /installCert /i vn1630`	Installs the driver for VN1630(A) silently.
`setup.exe /s /i keyman`	Installs the driver for the Vector Keyman silently.
`setup.exe /s /dongleDLLsOnly /i keyman`	Installs only the Vector Keyman API-DLLs silently. The CodeMeter runtime is not installed.
`setup.exe /s /dongleDLLsOnly /u keyman`	Uninstalls only the Vector Keyman API-DLLs silently. The CodeMeter runtime is not uninstalled.
`setup.exe /s /u vn1630`	Uninstalls the VN1630 driver from the system silently.

`setup.exe /info "Drivers.txt"`	Example output of `Drivers.txt`
	
	`[Common]`
	`version=0x703001e`
	`root=C:\Drivers\`
	`file1=setup.exe`
	`file2=DIFxAPI.dll`
	`file3=.\CommonFiles`
	`[CANboardXL]`
	`version=0x7030012`
	`path=.\CANboardXL`

3.1.3.2 Vector Platform Manager

Prerequisites

Administrative rights are required to use the `Vector Platform Manager Setup.exe` command line tool.

Options

The `Vector Platform Manager Setup.exe` can be found on the Vector Driver Disk and provides a command line interface as follows:

```
Vector Platform Manager Setup.exe [option]
```

Option	Command	Description
Silent mode	`/s /v /qn`	Executes the setup in silent mode. No user interaction is required.

3.1.3.3 Remarks

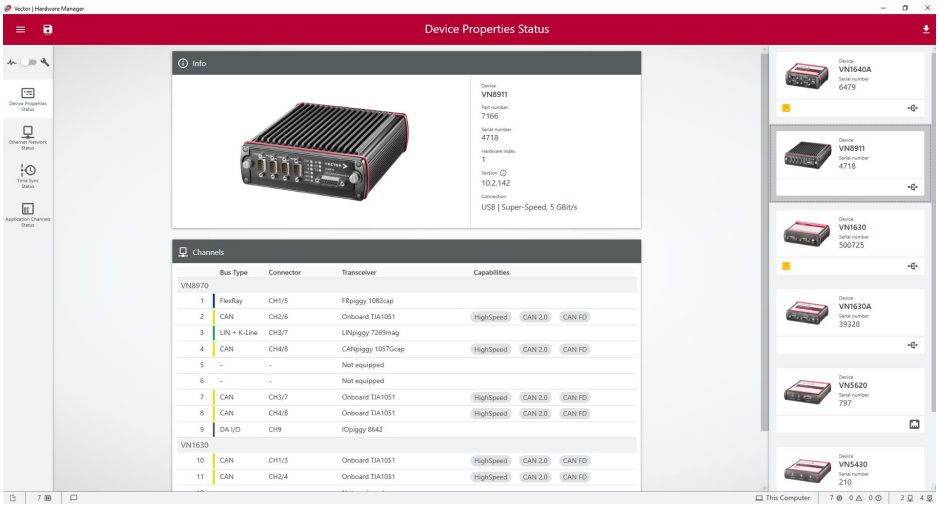
- **Windows 10 (64 bit) / Windows 11 (64 bit)**
  - Recommended installation command:
    `setup.exe /installCert /s /i all`
  - Recommended uninstallation command:
    `setup.exe /s /u all`
  - It is not possible to install the drivers from a network drive.
  - It is possible to pre-install the drivers, if the hardware is currently not connected. In this case, the installation of the driver automatically completes after connecting the device.
  - In order to use the silent mode (`/s`), the Vector certificate must be added to the trusted publishers. The Vector certificate can be added silently during the first installation by specifying the `/installCert` option. Any future installation of a Vector certified driver can be installed silently then.
  - The Vector certificate can also be added to the trusted publishers during the first installation by hitting the checkbox **Always trust content from this publisher**. This installs the Vector certificate locally. Any future installation of a Vector certified driver can be installed silently then.

3.2 Vector Hardware Manager

3.2.1 Hardware Configuration

General information

The **Vector Hardware Manager** is the successor of the Vector Hardware Config tool and a newly developed configuration and diagnostic tool for your installed Vector devices. It is strongly needed to set up your Vector devices for use with your Vector applications (e. g. CANoe, CANalyzer, CANape, ...).



3.2.2 Tool Location and Help

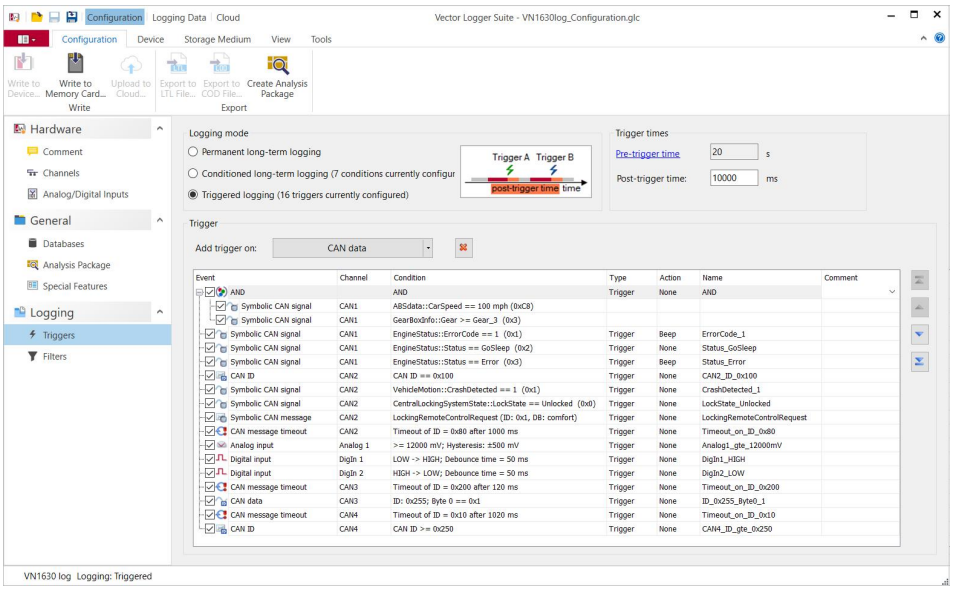
After successful driver installation of your Vector device, you will find the Vector Hardware Manager in the Windows Start menu or in the installation folder:
`C:\Program Files (x86)\Vector Hardware Manager\vHardwareManager.exe`

Reference
Details, tips and instructions for the Vector Hardware Manager can be found in the supplied help. You can open the help by pressing **<F1>** in the Vector Hardware Manager or directly via:
`C:\Program Files (x86)\Vector Hardware Manager\Help01\HTML5\VectorHardwareManager.htm`

For a brief introduction, we recommend reading the sections **Basic Concept** and **Quick Start Guide**. Furthermore, we have provided additional information for you in the section **Tips and Tutorials**.

3.2.3 For VN1630 log Users

For logging, the VN1630 log requires an additional configuration tool (Vector Logger Suite). Please follow the instructions below to install the tool.



Step by Step Procedure

The Vector Logger Suite can be installed as a 64-bit program. Due to the larger address space, the 64 bit variant can process very extensive databases. The 64 bit version can only be installed on 64 bit operating systems.

The Vector Logger Suite is installed as follows:

1. Execute the setup which is found on the driver disk:
   `.\Tools\VN1630_log\Setup_VLSuite_64Bit.exe`.
2. Please, follow the instructions in the setup program to complete the installation.
3. After successful installation, the Vector Logger Suite can be found in the start menu (if selected during installation).

Reference

Further information can be found in the separate manual provided with the **Vector Logger Suite**.

3.3 Loop Tests

Operation test

The test described here can be performed to check the functional integrity of the driver and the device. This test is identical for Windows 10 / Windows 11 and independent of the used application.

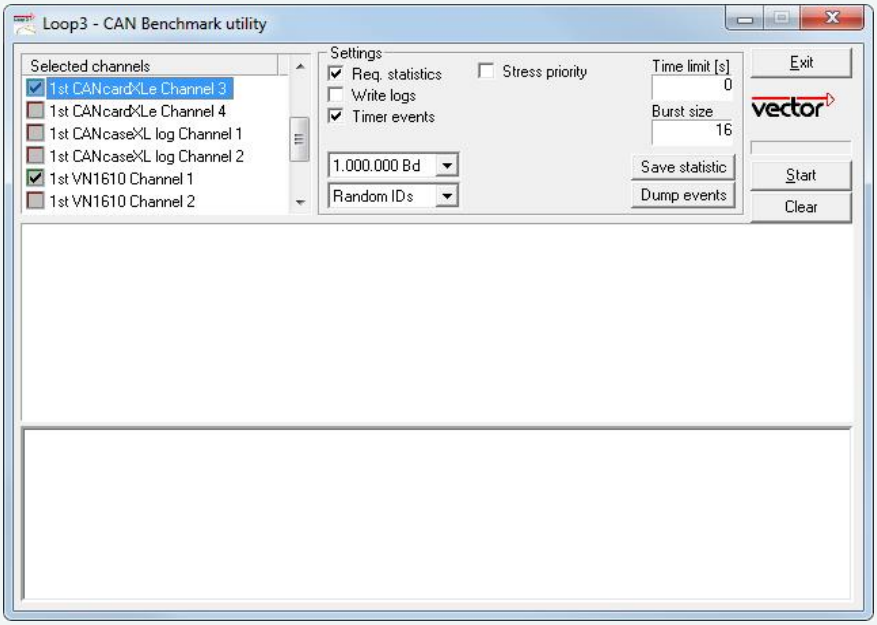
3.3.1 CAN

Device test

The operating test for CAN requires either two high-speed or two low-speed transceivers and can be executed as follows:

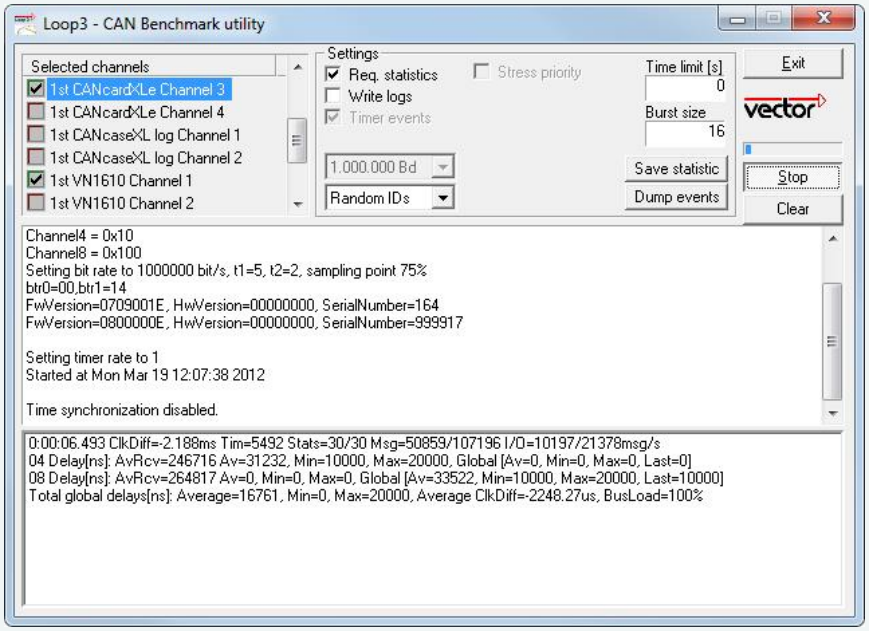
Step by Step Procedure

1. Connect two CAN channels with a suitable cable.
   If two high-speed transceivers are being used, we recommend our **CANcable1** (**CANcable0** for low-speed transceivers).
2. Start `\Drivers\Common\Loop3.exe` from the Vector Driver Setup.
   This program accesses the Vector devices and transmits CAN messages.

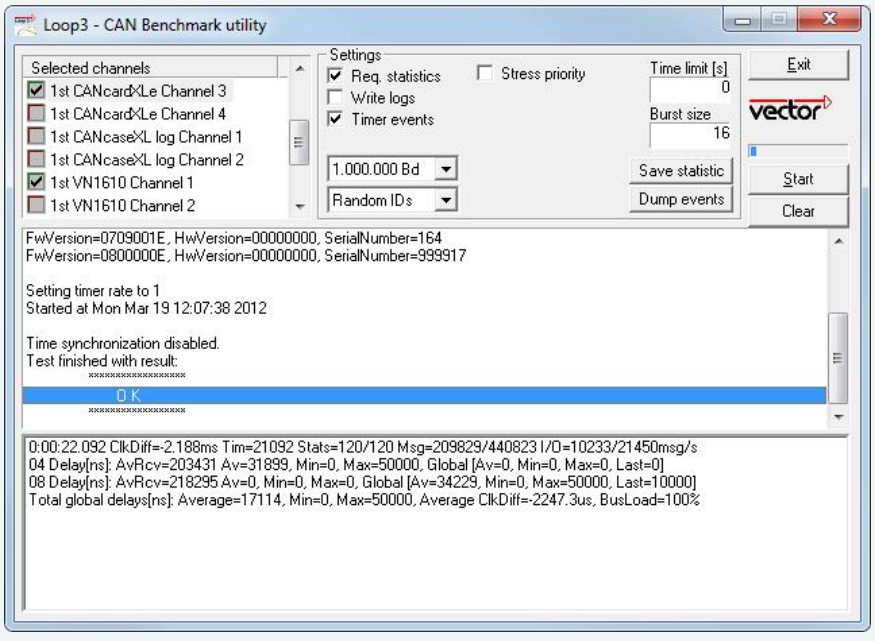


3. Select the connected CAN channels of the device(s) to be tested.

4. Set the appropriate baudrate depending on the transceiver being used (high-speed max. 1,000,000 Bd, low-speed max. 125,000 Bd).
5. Click **[Start]**.
6. You will see statistical data in the lower part of the window if the system has been configured properly.



7. The test procedure can be terminated with the **[Stop]** button.
   An **OK** should appear in the upper part of the window.



4 Time Synchronization

In this chapter you find the following information:

4.1 General Information 126

4.2 Software Sync 128
4.2.1 General Information 128
4.2.2 Configuration 128

4.3 Hardware Sync 129
4.3.1 General Information 129
4.3.2 Configuration 130

4.4 Precision Time Protocol Sync 131
4.4.1 General Information 131
4.4.2 Supported Features 131
4.4.3 Network Topology 132
4.4.4 Configuration 132

4.1 General Information

Time stamps and events

Time stamps are useful when analyzing incoming or outgoing data or event sequences on a specific bus.

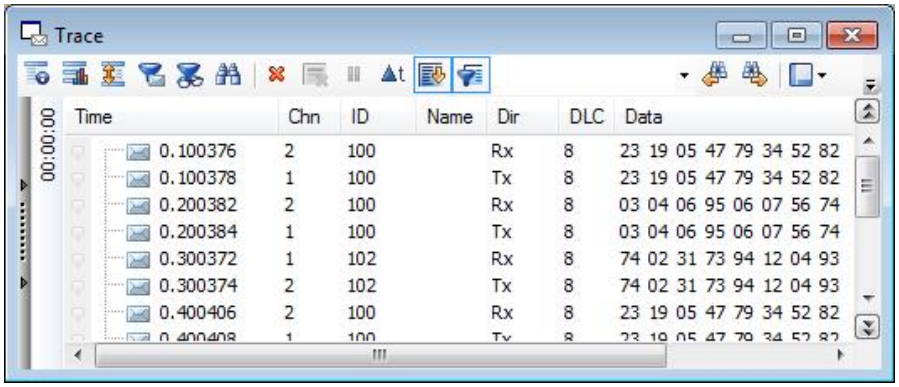


Figure 78: Time stamps of two CAN channels in CANalyzer

Generating time stamps

Each event which is sent or received by a Vector network interface has an accurate time stamp. Time stamps are generated for each channel in the Vector network interface. The base for these time stamps is a common hardware clock in the device.

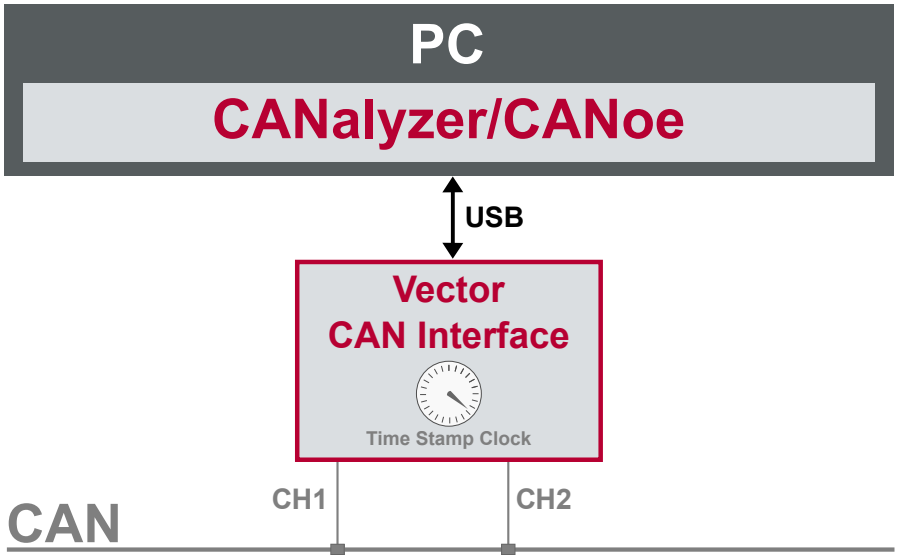


Figure 79: Common time stamp clock for each channel

If the measurement setup requires more than one Vector network interface, a synchronization of all connected interfaces and their hardware clocks is needed.

Due to manufacturing and temperature tolerances, the hardware clocks may vary in speed, so time stamps of various Vector devices drift over time.

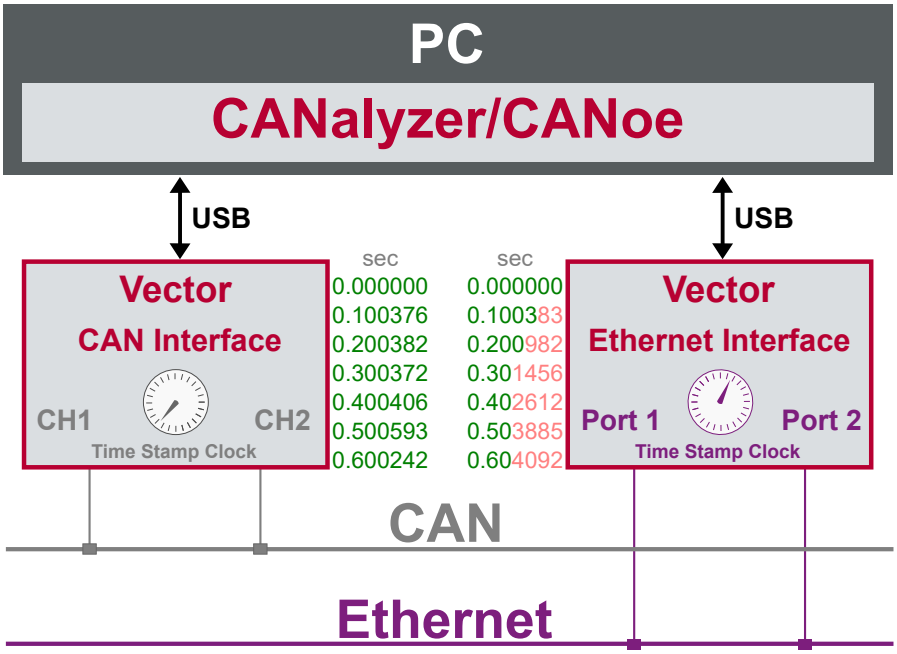


Figure 80: Example of unsynchronized network interfaces. Independent time stamps drift apart

To compensate for these time stamp deviations between the Vector network interfaces, the time stamps can be either synchronized by software, hardware, PTP or GNSS (capability depends on the Vector device).

Note
The accuracy of the software, hardware, PTP or GNSS sync depends on the interface. Further information on specific values can be found in the technical data of the respective devices.

4.2 Software Sync

4.2.1 General Information

Synchronization by software

The software time synchronization is driver-based and available for all applications without any restrictions. The time stamp deviations from different Vector network interfaces are calculated and synchronized to the common PC clock. For this purpose no further hardware setup is required.

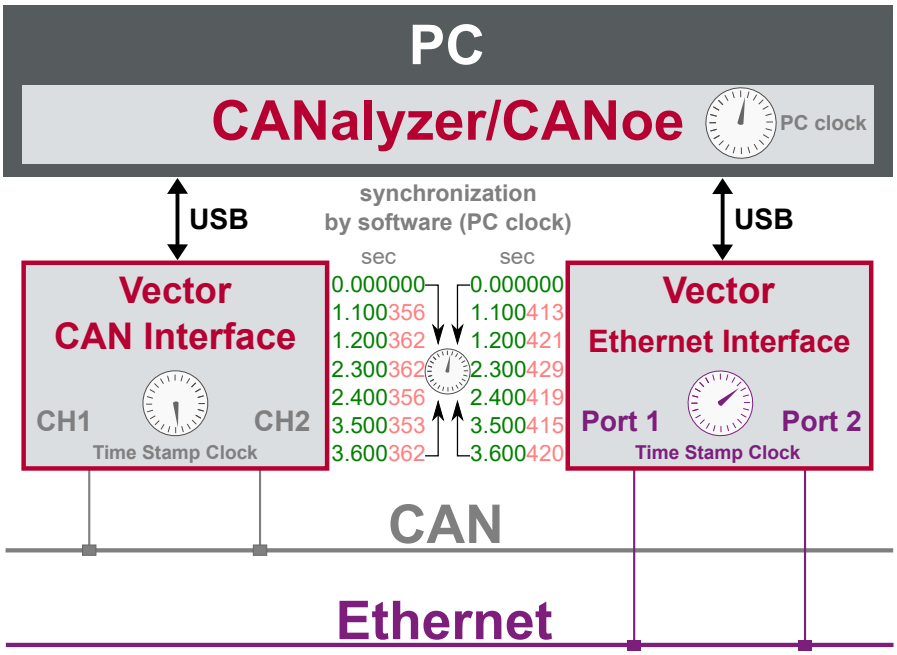


Figure 81: Time stamps of devices are synchronized to the PC clock

Note
Software time synchronization may lead to an increased latency for all connected Vector network interfaces. If a use case requires low latency, deactivate this option and use another synchronization mechanism.

4.2.2 Configuration

Vector Hardware Manager

Use the software synchronization if at least one device has no hardware sync connector. Also to synchronize the device clock to the computer time, use the software synchronization (legacy).

Reference
Further details and tips on the time sync configuration can be found in the Vector Hardware Manager help in section **User Interface | Navigation Rail | Time Sync**.

4.3 Hardware Sync

4.3.1 General Information

Synchronization by hardware

A more accurate time synchronization of multiple devices is provided by the hardware synchronization. Two Vector network interfaces can therefore be connected with the SYNCcableXL (see accessories manual, part number 05018).

In order to synchronize up to five devices at the same time, a distribution box is available (see accessories manual, part number 05085).

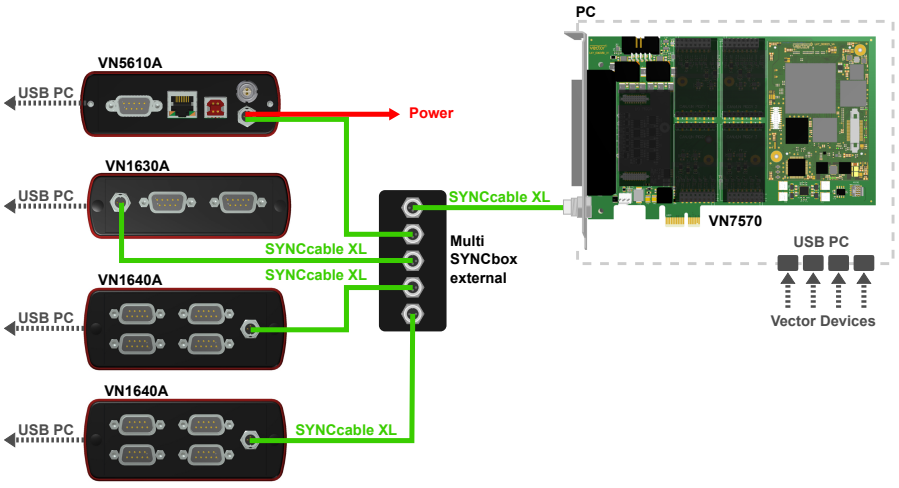


Figure 82: Example of a time synchronization with multiple devices

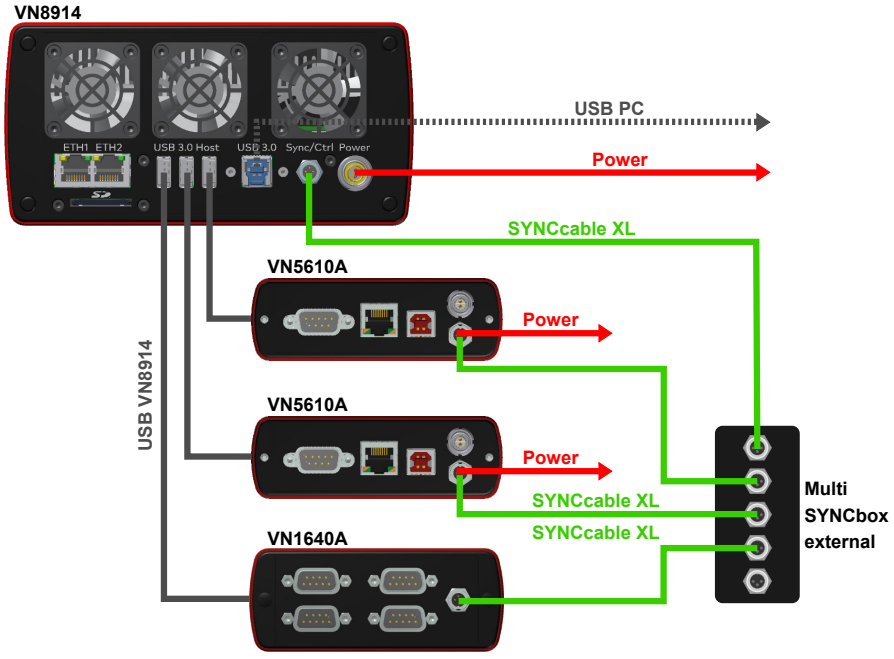


Figure 83: Example of a time synchronization with VN8914 and additional devices

At each falling edge on the sync line which is initiated by the driver, the Vector network interface generates a time stamp that is provided to the driver. This allows the driver to calculate the deviations between the network interfaces and to synchronize the time stamps to a common time base (master clock) which can be

defined by the user.

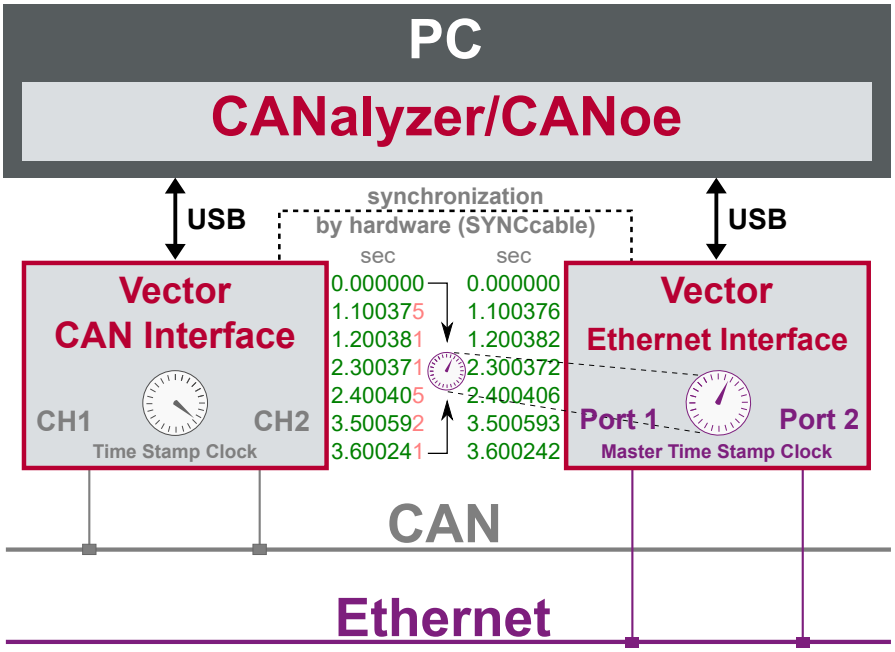


Figure 84: Time stamps are synchronized to the master clock

4.3.2 Configuration

Vector Hardware Manager

Use hardware synchronization if at least one device is connected with USB or PCIe to the PC and all devices are hardware sync capable. One device should be configured as master and all other devices as slaves. Therefore, all devices must be interconnected with SYNCcableXL and Multi SYNCbox external or SYNCbox active.

Reference
Further details and tips on the time sync configuration can be found in the Vector Hardware Manager help in section **User Interface | Navigation Rail | Time Sync**.

4.4 Precision Time Protocol Sync

4.4.1 General Information

Overview

The Precision Time Protocol (PTP) is a protocol used to synchronize clocks through a computer network. On a local area network, it achieves a synchronization accuracy in the sub-microsecond range, making it suitable for measurement and control systems.

Note
The PTP feature can only be used on the Ethernet host ports of these devices. Therefore, it can only be used, if the device is connected via Ethernet host port to the PC.

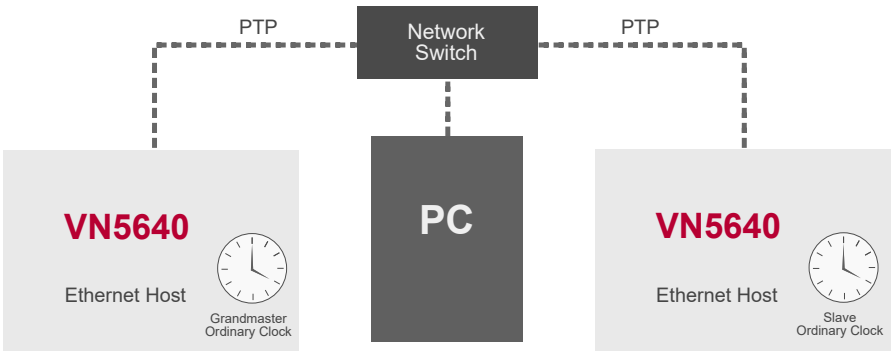


Figure 85: Setup example

4.4.2 Supported Features

Vector network interfaces support time synchronization with IEEE1588-2008 standard. The following IEEE1588 features are supported:

IEEE1588 Features	VN Device Support
Clock Types	
Ordinary Clock Master	X
Ordinary Clock Slave	X
Synchronization	
2-step clock	X
E2E	X
BMCA	X
Transport	
PTP over UDP with IPv4	X
PTP over UDP with IPv6	-
Multicast Master/Slave	X
Unicast Master/Slave	-
Synchronization accuracy	
1 µs	X

4.4.3 Network Topology

Network switches

To achieve a maximum accuracy, PTP needs transparent clock support in network equipment. Therefore, a PTP transparent clock capable network switch is strongly suggested.

4.4.4 Configuration

Vector Hardware Manager

Use the PTP synchronization if all devices are connected via Ethernet host port to the PC and one device is configured as master and all other devices are configured as slaves.



Reference
Further details and tips on the time sync configuration can be found in the Vector Hardware Manager help in section **User Interface | Navigation Rail | Time Sync**.

5 Vehicle Electrics and Ground/Earth

In this chapter you find the following information:

5.1 General Information **134**

5.2 Vehicle Battery Only (Closed System) **135**

5.3 External Power Supplies (Test Bench) **136**

5.1 General Information



Caution!
When using Vector devices, ensure that the power supply and earthing are correct. Failure to do so may result in damage to the vehicle electronics or the Vector devices due to overvoltage. Two typical scenarios are described below.

5.2 Vehicle Battery Only (Closed System)

In this scenario, the individual Vector devices are powered directly from the vehicle battery. A third device is powered via USB (e. g. from a notebook in battery mode or from the vehicle battery). The system is therefore closed.

The common reference ground is the chassis, which is connected to the negative terminal of the vehicle battery. Vector devices that have a functional earth connection (FE) must also be connected to the reference ground.

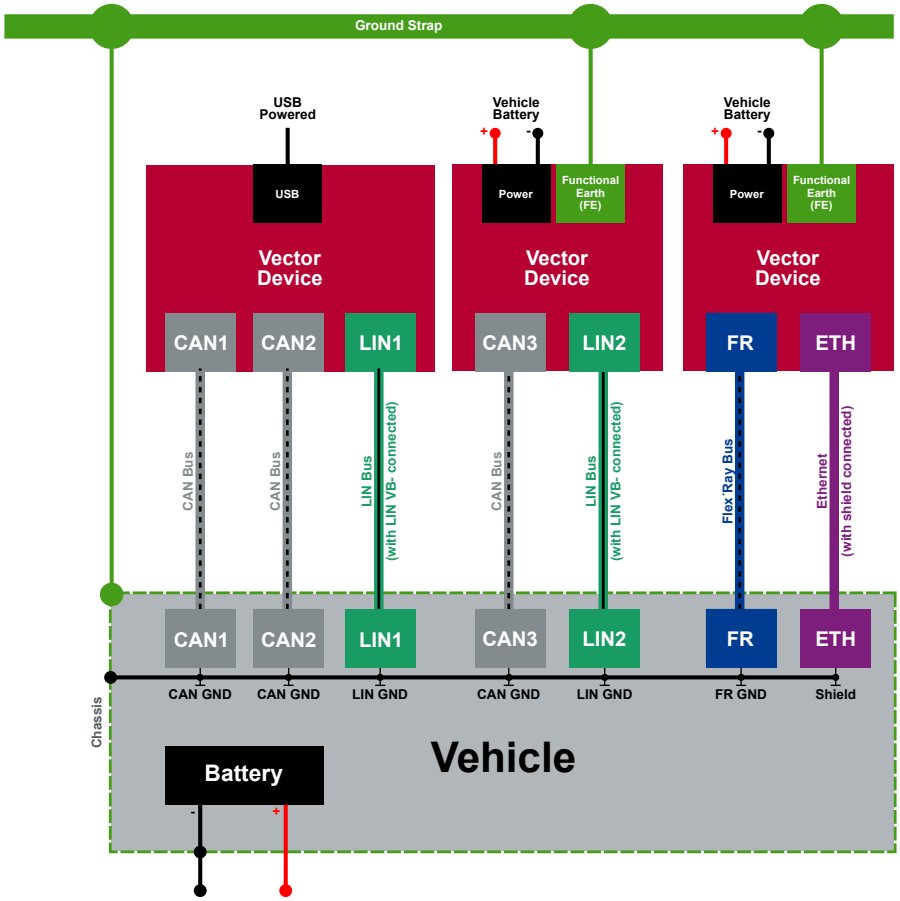


Figure 86: Vector devices powered by vehicle battery

The individual GNDs of the ECUs (in this example CAN, LIN, FlexRay) are connected to the chassis on the vehicle side. The shielding of the Ethernet connections is also connected to the chassis.

In this scenario, LIN VB- must be connected in the LIN signal path (LIN always requires VB- to be connected). For CAN and FlexRay it is recommended to connect all signal GNDs via their connectors (CAN GND, FlexRay VB-) to have the same reference ground from the vehicle battery.

5.3 External Power Supplies (Test Bench)

In this scenario, the individual Vector devices are powered by individual power supplies. A third device is powered via USB. This is a typical test bench scenario.

The common reference ground is earth, which is also connected to the chassis and to the negative terminal of the vehicle battery. Vector devices that have a functional earth connection (FE) must also be connected to the reference ground.

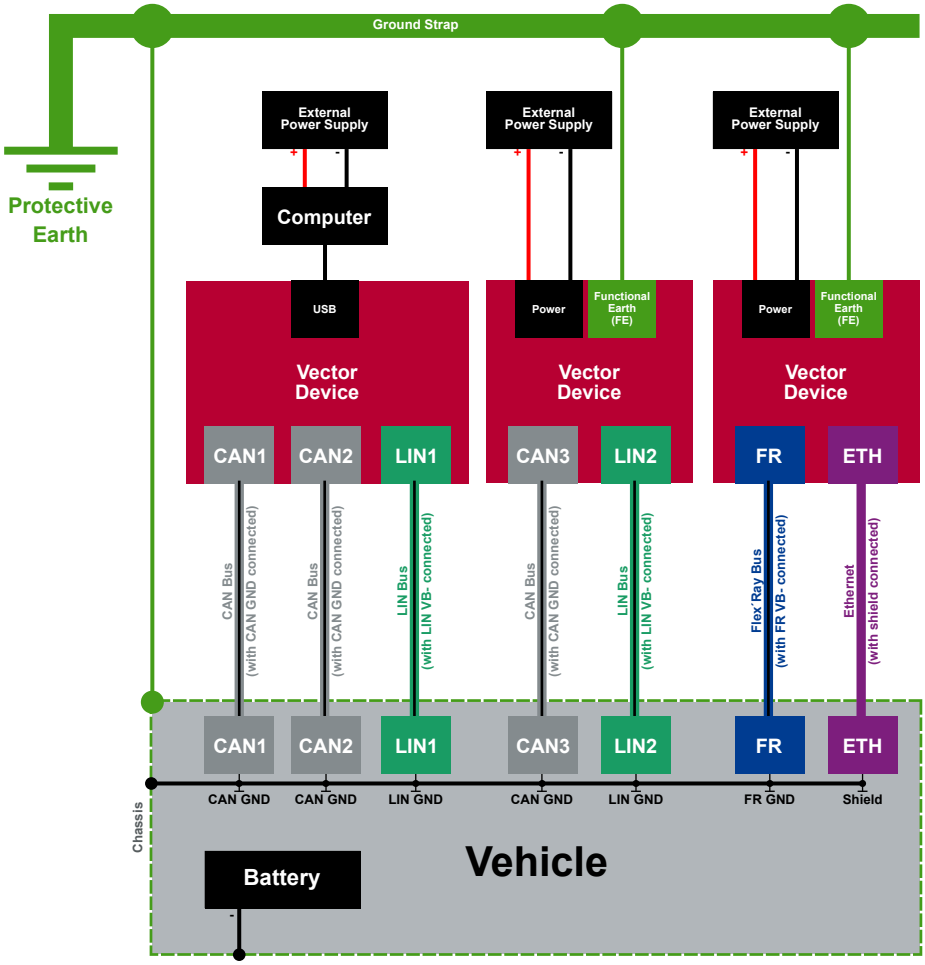


Figure 87: Test bench scenario

The individual GNDs of the ECUs (in this example CAN, LIN, FlexRay) are connected to the chassis on the vehicle side. The shielding of the Ethernet connections is also connected to the chassis.

In this scenario, all signal GNDs must be connected via their connectors (CAN GND, LIN VB-, FlexRay VB-) to have the same reference ground.

6 Important Notes - Details

In this chapter you find the following information:

6.1 Safety Instructions and Hazard Warnings 138
6.1.1 Proper Use and Intended Purpose 138
6.1.2 Hazards 139
6.2 Disclaimer 140
6.3 Licenses 141
6.3.1 SEGGER emFile Module 141
6.4 Disposal of Vector Hardware 142

6.1 Safety Instructions and Hazard Warnings



Caution!
In order to avoid personal injuries and damage to property, you have to read and understand the following safety instructions and hazard warnings prior to installation and use of this interface. Keep this documentation (manual) always near the interface.

6.1.1 Proper Use and Intended Purpose



Caution!
The interface is designed for analyzing, controlling and otherwise influencing control systems and electronic control units. This includes, inter alia, bus systems like CAN, LIN, K-Line, MOST, FlexRay, Ethernet, BroadR-Reach and/or ARINC 429.

The interface may only be operated in a closed state. In particular, printed circuits must not be visible. The interface may only be operated (i) according to the instructions and descriptions of this manual; (ii) with the electric power supply designed for the interface, e.g. USB-powered power supply; and (iii) with accessories manufactured or approved by Vector.

The interface is exclusively designed for use by skilled personnel as its operation may result in serious personal injuries and damage to property. Therefore, only those persons may operate the interface who (i) have understood the possible effects of the actions which may be caused by the interface; (ii) are specifically trained in the handling with the interface, bus systems and the system intended to be influenced; and (iii) have sufficient experience in using the interface safely.

The knowledge necessary for the operation of the interface can be acquired in work-shops and internal or external seminars offered by Vector. Additional and interface specific information, such as „Known Issues“, are available in the „Vector KnowledgeBase“ on Vector´s website at www.vector.com. Please consult the „Vector KnowledgeBase“ for updated information prior to the operation of the interface.

6.1.2 Hazards

Caution!
The interface may control and/or otherwise influence the behavior of control systems and electronic control units. Serious hazards for life, body and property may arise, in particular, without limitation, by interventions in safety relevant systems (e.g. by deactivating or otherwise manipulating the engine management, steering, airbag and/or braking system) and/or if the interface is operated in public areas (e.g. public traffic, airspace). Therefore, you must always ensure that the interface is used in a safe manner. This includes, inter alia, the ability to put the system in which the interface is used into a safe state at any time (e.g. by „emergency shutdown“), in particular, without limitation, in the event of errors or hazards.

Comply with all safety standards and public regulations which are relevant for the operation of the system. Before you operate the system in public areas, it should be tested on a site which is not accessible to the public and specifically prepared for performing test drives in order to reduce hazards.

6.2 Disclaimer



Caution!
Claims based on defects and liability claims against Vector are excluded to the extent damages or errors are caused by improper use of the interface or use not according to its intended purpose. The same applies to damages or errors arising from insufficient training or lack of experience of personnel using the interface.

6.3 Licenses

6.3.1 SEGGER emFile Module



Caution!
The firmware of the VN1630 log contains the copyright protected emFile module of SEGGER Microcontroller GmbH & Co. KG.

It should be noted that, in addition to the safety and hazard notes provided in section Important Notes - Details, the Licensing Terms of the Licensor expressly prohibit the use of the SEGGER emFile module in weapons/weapons systems and/or their deployment in same. A “weapons system” is to be understood as meaning, in particular, a system whose primary or material purpose is to injure, incapacitate or kill a person or an opponent, or to destroy or damage the property of a person or an opponent, or to threaten a person or an opponent, irrespective of whether the weapon or the weapon system can be used to attack, defend, threaten or protect.

6.4 Disposal of Vector Hardware

Please handle old devices responsibly and observe the environmental laws applicable in your country. Please dispose of the Vector hardware only at the designated places and not with the household waste.



Within the European Community, the Directive on Waste Electrical and Electronic Equipment (WEEE Directive) and the Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS Directive) apply.

For Germany and other EU countries, we offer free take-back of old Vector hardware.

Please carefully check the Vector hardware to be disposed of before shipping. Please remove all items that are not part of the original scope of delivery, e.g. storage media. The Vector hardware must also be free of licenses and must no longer contain any personal data. Vector does not perform any checks in this regard.
Once the hardware has been shipped, it cannot be returned to you. By shipping the hardware to us, you have relinquished your rights to the hardware.
Before shipping, please register your old device via:

https://www.vector.com/int/en/support-downloads/return-registration-for-the-disposal-of-vector-hardware/

7 Wichtige Hinweise

In diesem Kapitel finden Sie die folgenden Informationen:

7.1 Sicherheits- und Gefahrenhinweise 144
7.1.1 Sach- und bestimmungsgemäßer Gebrauch 144
7.1.2 Gefahren 145

7.2 Haftungsausschluss 146

7.3 Lizenzen 147
7.3.1 SEGGER emFile Modul 147

7.4 Entsorgung von Vector Hardware 148

7.1 Sicherheits- und Gefahrenhinweise



Achtung!
Um Personen- und Sachschäden zu vermeiden, müssen Sie vor der Installation und dem Einsatz dieses Interfaces die nachfolgenden Sicherheits- und Gefahrenhinweise lesen und verstehen. Bewahren Sie diese Dokumentation (Handbuch) stets in der Nähe dieses Interfaces auf.

7.1.1 Sach- und bestimmungsgemäßer Gebrauch



Achtung!
Das Interface ist für die Analyse, die Steuerung sowie für die anderweitige Beeinflussung von Regelsystemen und Steuergeräten bestimmt. Das umfasst unter anderem die Bussysteme CAN, LIN, K-Line, MOST, FlexRay, Ethernet, BroadR-Reach oder ARINC 429.

Der Betrieb des Interfaces darf nur im geschlossen Zustand erfolgen. Insbesondere dürfen keine Leiterplatten sichtbar sein. Das Interface ist entsprechend den Anweisungen und Beschreibungen dieses Handbuchs einzusetzen. Dabei darf nur die dafür vorgesehene Stromversorgung, wie z. B. USB-powered, Netzteil, und das Originalzubehör von Vector bzw. das von Vector freigegebene Zubehör verwendet werden.

Das Interface ist ausschließlich für den Einsatz durch geeignetes Personal bestimmt, da der Gebrauch dieses Interfaces zu erheblichen Personen- und Sachschäden führen kann. Deshalb dürfen nur solche Personen dieses Interface einsetzen, welche die möglichen Konsequenzen der Aktionen mit diesem Interface verstanden haben, speziell für den Umgang mit diesem Interface, den Bussystemen und dem zu beeinflussenden System geschult worden sind und ausreichende Erfahrung im sicheren Umgang mit dem Interface erlangt haben.

Die notwendigen Kenntnisse zum Einsatz dieses Interfaces können bei Vector über interne oder externe Seminare und Workshops erworben werden. Darüber hinausgehende und Interface-spezifische Informationen wie z. B. „Known Issues“ sind auf der Vector Webseite unter www.vector.com in der „Vector KnowledgeBase“ verfügbar. Bitte informieren Sie sich dort vor dem Betrieb des Interfaces über aktualisierte Hinweise.

7.1.2 Gefahren



Achtung!
Das Interface kann das Verhalten von Regelsystemen und Steuergeräten steuern und in anderweitiger Weise beeinflussen. Insbesondere durch Eingriffe in sicherheitsrelevante Bereiche (z. B. durch Deaktivierung oder sonstige Manipulation der Motorsteuerung, des Lenk-, Airbag-, oder Bremssystems) und/oder der Einsatz des Interfaces in öffentlichen Räumen (z. B. Straßenverkehr, Luftraum) können erhebliche Gefahren für Leib, Leben und Eigentum entstehen. Stellen Sie daher in jedem Fall eine gefahrfreie Verwendung sicher. Hierzu gehört unter anderem auch, dass das System, in dem das Interface eingesetzt wird, jederzeit, insbesondere bei Auftreten von Fehlern oder Gefahren, in einen sicheren Zustand geführt werden kann (z. B. durch Not-Abschaltung).

Beachten Sie alle sicherheitstechnischen Richtlinien und öffentlich-rechtlichen Vorschriften, die für den Einsatz des Systems relevant sind. Zur Verminderung von Gefahren sollte das System vor dem Einsatz in öffentlichen Räumen auf einem nicht-öffentlich zugänglichen und für Testfahrten bestimmten Gelände erprobt werden.

7.2 Haftungsausschluss



Achtung!
Soweit das Interface nicht sach- oder bestimmungsgemäß eingesetzt wird, übernimmt Vector keine Gewährleistung oder Haftung für dadurch verursachte Schäden oder Fehler. Das Gleiche gilt für Schäden oder Fehler, die auf einer mangelnden Schulung oder Erfahrung derjenigen Personen beruhen, die das Interface einsetzen.

7.3 Lizenzen

7.3.1 SEGGER emFile Modul

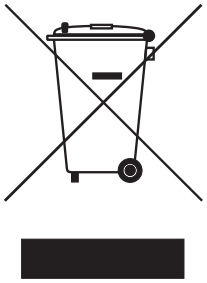


Achtung!
Die Firmware des VN1630 log beinhaltet das urheberrechtlich geschützte Modul emFile der SEGGER Microcontroller GmbH & Co. KG.

Ergänzend zu den Sicherheits-und Gefahrenhinweisen in Abschnitt Wichtige Hinweise wird ausdrücklich darauf hingewiesen, dass gemäß den Lizenzbedingungen des Lizenzgebers die Nutzung des emFile Modules von Segger bzw. dessen Einsatz in Waffen/Waffensystemen verboten ist. Als Waffensystem ist insbesondere ein solches System zu verstehen, das den vorrangigen oder wesentlichen Zweck hat, eine Person oder ein Gegner zu verletzen, handlungsunfähig zu machen oder zu töten oder das Eigentum einer Person oder eines Gegners zu zerstören oder zu beschädigen oder eine Person oder einen Gegner zu bedrohen, unabhängig davon, ob die Waffe oder das Waffensystem zum Angriff, zur Verteidigung, zur Drohung oder zum Schutz genutzt werden kann.

7.4 Entsorgung von Vector Hardware

Bitte gehen Sie verantwortungsvoll mit Altgeräten um und beachten Sie die in Ihrem Land geltenden Umweltgesetze. Entsorgen Sie die Vector Hardware bitte nur bei den dafür vorgesehenen Stellen und nicht über den Hausmüll.



Innerhalb der Europäischen Gemeinschaft gelten die Richtlinie über Elektro- und Elektronik-Altgeräte (WEEE-Richtlinie) und die Richtlinie zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten (RoHS-Richtlinie).

Für Deutschland und andere EU-Länder bieten wir Ihnen eine kostenlose Rücknahme der alten Vector Hardware an.

Bitte überprüfen Sie die zu entsorgende Vector Hardware vor dem Versand sorgfältig. Bitte entfernen Sie alle Gegenstände, die nicht zum ursprünglichen Lieferumfang gehören, z. B. Speichermedien. Die Vector Hardware muss außerdem frei von Lizenzen sein und darf keine personenbezogenen Daten mehr enthalten. Vector führt keine Kontrollen diesbezüglich durch. Sobald die Hardware versandt wurde, kann sie nicht mehr an Sie zurück geliefert werden. Mit dem Versand der Hardware an uns haben Sie Ihre Rechte an der Hardware abgetreten. Bitte melden Sie vor dem Versand Ihr Altgerät an über:

https://www.vector.com/de/de/support-downloads/return-registration-for-the-disposal-of-vector-hardware/

VECTOR

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